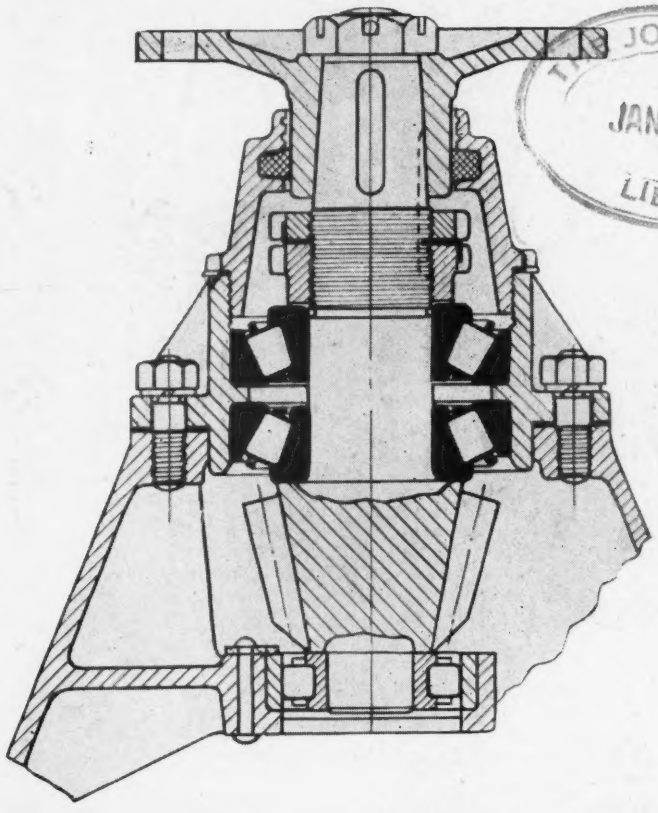
625.6 P4

AUTOMOBILE ENGINEER

DESIGN · PRODUCTION · MATERIALS

Vol. 40 No. 535. DECEMBER, 1950 PRICE : 2s. 6d.

JOHN CRERAR LIBRARY JAN 31 1951



Straddle-mounting the hypoid pinion

This is an alternative to the mounting previously shown here. The pinion is end-located by a pair of pre-loaded Timken tapered-roller bearings, with a parallel-roller bearing* to support the small end.

This mounting gives great stiffness, quiet running and durability; the thrust and journal loads are generously met, and moreover, the thrust centralizes the pinion.

** As made by our Subsidiary Company, Fischer Bearings Co., Ltd., Wolverhampton, makers of FBC ball and roller bearings, etc.*

TIMKEN

BRITISH TIMKEN LIMITED, BIRMINGHAM, and DUSTON NORTHAMPTON

Telephone : East 1321. *Telegrams : "Britimken, Birmingham."*

Subsidiary Company : Fischer Bearings, Co. Ltd., Wolverhampton, makers of FBC ball and roller bearings and transmission equipment.

ESC SPRINGS

FOR EASY RIDING

ESC laminated and coil springs produced from our special quality alloy steels are supplied in large quantities to the motor trade.
May we include you on our list of customers.

(Illustrations by courtesy of The Nuffield Organisation and Standard Motors.)

ENGLISH STEEL CORPORATION LTD

VICKERS WORKS **SHEFFIELD**

AUTOMOBILE ENGINEER

Design, Materials, Production Methods, and Works Equipment

Editorial Director : G. GEOFFREY SMITH, M.B.E.
Editor : W. L. FISHER, M.I.Mech.E., M.S.A.E.
Assistant Editor : M. S. CROSTHWAITE, A.M.I.Mech.E., M.S.A.E. Tools and Production : J. B. DUNCAN

Publishers: ILIFFE & SONS LTD., DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Sliderule, Sedist, London **Telephone: Waterloo 3333 (60 lines)**

COVENTRY:	BIRMINGHAM, 2	MANCHESTER, 3:	GLASGOW, C.2
8–10, CORPORATION ST.	KING EDWARD HOUSE, NEW ST.	260, DEANSGATE	26B, RENFIELD ST.
Telegrams: Autocar, Coventry	*Telegrams:* Autopress, Birmingham	*Telegrams:* Iliffe, Manchester	*Telegrams:* Iliffe, Glasgow
Telephone: Coventry 5210	*Telephone:* Midland 7191-7	*Telephone:* Blackfriars 4412	*Telephone:* Central 4857

PUBLISHED MONTHLY—SECOND THURSDAY

Annual Subscription: Home and Overseas £1 17s. 6d., including the Special Number; U.S.A. $6.00; Canada $5.00

VOL. XL. No. 534 DECEMBER 1950 PRICE 2S. 6D.

Aerodynamics

ALL modern cars embody a considerable measure of so called streamlining, but little attention has however, been devoted to the really scientific aspects of aerodynamic design. Nevertheless, all progressive thinkers realise that for several reasons true streamlining will ultimately become important. In fact, the time is already ripe for a thorough investigation into the airflow conditions around motor cars, in order to discover methods by which the flow can be most beneficially controlled.

Regarding the present technical situation, on the Continent, the accent at the moment is upon the smallest, lightest and cheapest cars. Even in America the emphasis has shifted from sheer size to compactness and economy. Further, a number of small American cars have appeared. The probability is that we are in fact on the threshold of an era of austerity motoring, when emphasis will be focused on low price and low operating costs. Should this be so, then both low weight and resistance to motion will be prime objectives. When a car is small however, its frontal area does not greatly decrease, since it must still accommodate full size people. In order to save weight, it may be made shorter, with a higher floor over the mechanism, and more upright seating, possibly resulting in an increase of frontal resistance to air flow. In short, the wind forces acting on a small car will be of much the same order of magnitude as those acting on a comparatively large car at a given speed.

Effective Streamlining

Progress in design technique of the austerity car will lead to some reduction in weight, and with consequent reduction in rolling resistance of the tyres. When the tare weight of the car is in the region of 1,000 lb., with present-day body shapes, at 45 m.p.h., the air resistance constitutes about three-quarters of the total resistance. It would appear therefore that economy, at present-day speeds, can only be materially improved by genuine streamlining. As speeds increase, true streamlining will become even more important. How far is it really practicable to streamline a production light car ? Is it possible, by careful aerodynamic treatment, to dispense with the all-enclosing undertray, without a serious loss in aerodynamic efficiency ?

As high speeds are approached, the wind forces tend to affect even quite large cars and make them directionally unstable. Certainly some small cars wander about the road far too much under the influence of strong winds. The matter of stability becomes more serious with increase of speed or decrease of weight, and probably also with streamlining, unless special care is taken to ensure directional stability. How much of the appearance, overall size, or even driver's visibility must be sacrificed in order to secure a useful gain in performance and stability ? The answers to such questions can all be arrived at by experiment. If the gain in stability is useful, the first cars to embody the benefits of this knowledge will undoubtedly be sought after. If this research work is done abroad, a foreign manufacturer will gain the commercial advantage and prestige.

Secondary Effects

Apart from the major factors involved in the aerodynamic characteristics of a car, there are a number of less obvious directions in which knowledge of the air flow conditions may prove of benefit. The dimensions and disposition of the radiator may be influenced by effective knowledge of the flow of air, thus saving cost and weight in the radiator itself. On some vehicles the airflow through the radiator is poor, so that the block has to be larger than would be necessary under good conditions. Ventilation of the body depends entirely upon the pressure distribution over the outside. The inlets and exits must be suitably disposed to circulate clean air through the interior. It is not unknown for engine or exhaust fumes to enter the body of a car, sometimes only under one particular condition of operation. This is due to the relative dispositions of exhaust pipes, cooling air outlets and holes which serve as ventilators.

A cure can only be effected if there is a full knowledge of the air flow conditions all over the outside of the body. Much more data on the pressure distribution round motor car bodies is needed. Does anybody know how the pressure distribution varies in the normal conditions of a car operating in a side wind ? The modern, partially streamlined car is a much quieter machine than its predecessor, but its passengers are continuously assailed by wind noises of one sort and another. These are caused by rain gutters, small holes, proturberances, and other broken surfaces, and could be tracked down by wind tunnel tests.

How reliable are wind tunnel tests of models in indicating the aerodynamic characteristics of the full scale car ? The probability is that model tests are comparative only and

there must be considerable discrepancy between them and the full scale car. This may to some degree, be due to different interference effects as the full scale car moves over the road, whereas the road may move with the car in the model test. Serious scientific tests are required to determine the magnitude of the discrepancy.

In addition to the improvements that could be made in the production car, by a thorough investigation of its aerodynamics, it is also possible that further advances might be possible even on special record breaking or racing machines. In any event there can be little doubt that design has now reached a stage when sound and reliable aerodynamic knowledge should be at the disposal of the motor industry.

High Speed Testing

A MATTER that is closely related to the investigation of the aerodynamics of the car, is the M.I.R.A. project for a high speed circuit at the proving ground at Silverstone. The potential speeds of modern cars have risen so greatly that it is most important that designers should know what these capabilities entail in the way of sustained performance and durability. The fact that the bulk of the British output is exported, adds to the importance of this matter. Large numbers of cars are now finding their way to countries where sustained high speeds are both possible and customary, and as a result it is essential that facilities be available for investigating at home the behaviour of British cars.

In the past it has been necessary to take cars abroad for this purpose, and even so, no thoroughly satisfactory investigation could be made. Apart from the matter of simple durability, it is essential that makers be able to find out precisely what fuel consumptions are entailed at high speeds, and also how these consumptions are affected by body shapes. Another and most important factor is that of high speed handling. A proving ground that includes a complete high speed circuit should permit studies to be made of the effects of wind from various angles of attack. Tyre manufacturers also will want to know what actually are the effects of high cruising speeds over sustained mileages.

The effectiveness of air conditioning systems in the body is another matter upon which much information could be obtained on a really high speed circuit. The effectiveness of various types of air intake and ventilation could be studied. There is also the matter of engine cooling and the drag effect of various cooling systems. In this connection, the question of evolving some measure of control over the cooling system merits attention. Many cars that are at present liable to over-heat and boil under traffic conditions will grow steadily colder and colder if driven at sustained high speed, even in summer weather. Under really cold conditions they definitely need half the radiator surface blanked off.

Then there is the matter of bearing life, and most important of all, the largely unsolved problems of brake fade when successive stops are made from really high speeds. It is to be hoped that the M.I.R.A. scheme will not only go forward, but will be pressed ahead with all possible speed.

Transfer Machining

THERE has recently been a revival of interest in the possibilities of reducing production costs by the use of transfer machines. For many years in this country interest in such machines had lain dormant, but reports of American trends since the war have reawakened interest. Already considerable developments have been carried out in this country and at least one British machine tool manufacturer, J. Archdale and Co. Ltd. has built some remarkably successful machines.

This production technique has not yet won general acceptance. Many production engineers, both in this country and on the Continent, still consider that the conventional use of individual machines is the better practice. How far this is merely innate conservatism and how far it is based upon a reasoned examination of the factors involved, it is not possible to say.

Practical Economies

Experience has shown that in suitable applications, transfer machines lead to a reduction in direct labour costs and to a saving in machining time. These are the chief benefits to be obtained. There is, however, another, and not unimportant benefit that may be derived from a study of transfer machining technique. It will in many organizations entail an entirely new approach to the design of work fixtures.

Work fixtures for transfer machining must be designed with open ends so that the work may be fed in from one end and taken out from the other. This principle could be applied with advantage to many operations for which individual machines are used. Where it is adopted, a good deal of work handling is eliminated. There is little doubt that a study of work fixtures for transfer machines will greatly influence the design of work fixtures for other machines, particularly in three respects, ease of loading and unloading, location methods, and clamping methods.

CONTENTS OF THIS ISSUE

	Page
Editorials ..... Aerodynamics. High-speed Testing. Transfer Machining.	413-414
Earls Court Exhibition ..... A Survey of Coachwork, Frames, Brakes and Electrical Equipment.	415-432
Coachwork ..... Wider Use of All-Metal Construction.	415-423
Frames ..... Light Weight with Stiffness, the Prime Objectives.	424-425
Brakes ..... Continued Developments of Existing Layouts.	425-427
Electrical Equipment ..... Minor Advances and Detail Improvement.	427-432
Broaching ..... Standard In-and-Out Fixtures and an Automatic Machining Cycle.	432
The Paris Salon ..... More Stabilised Conditions and an Absence of Eccentric Designs.	433-441
Commercial Vehicle Brakes ..... A New Girling Range for Medium and Heavy Vehicles.	442-444
Continuous Strip Mill ..... An Important Development by Northern Aluminium Company Limited.	445-451
Correspondence	451
Current Patents ..... A Comprehensive Review of Recent Automobile Specifications.	452

EARLS COURT EXHIBITION

A Survey of Coachwork, Frames, Brakes and Electrical Equipment

COACHWORK

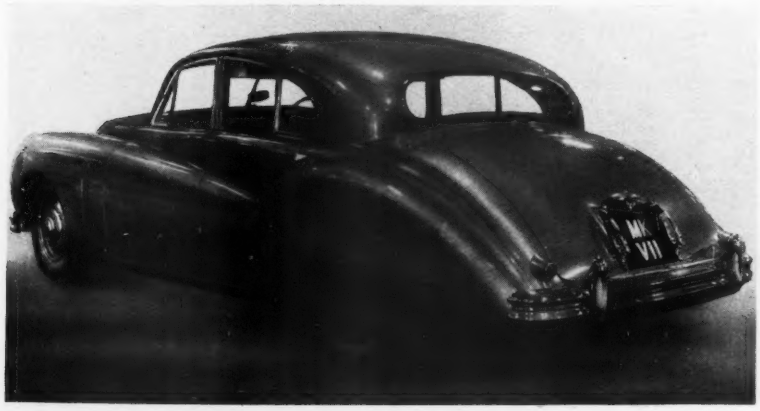
Wider Use of All-Metal Construction

ONE of the main impressions in the matter of bodywork is that stylists have not yet quite decided what the prevailing form should be. The specialist coach-builder seems to have forsaken the bold wing treatment running through on to the doors and linking the front and rear wings. As this gives a continuous upper line corresponding in height to the normal waist moulding, it produces a somewhat bulky door, the width of the body throughout its run being appreciably wider at the base of the door than at the glass line. On certain new models which are the standard productions of car manufacturers this linked wide wing treatment is still used, but nowadays it seems to some degree dated and produces a bulbous and somewhat characterless vehicle. From the fact that new models are still appearing in this form it is obvious that this rather ponderous wing treatment will be a feature of the motor industry's productions for some years to come. In front end treatment, while some have considered that the ostentatious chromium grille is the line to follow, it may be noted that this year one well known maker has reverted to the traditional radiator shell form. Further, one of the latest and most striking models retains the traditional radiator grille in reduced form. This is the new Jaguar model, and proved to be the focal point of the Exhibition. It combines the performance of the Jaguar XK120 sports model with the comfort and elegance of a four-door saloon. It has now an entirely new and larger body of streamline form and is a product fully in keeping with the bodywork traditions of this now famous firm. A point that has a considerable bearing on interior comfort is that the whole seating accommodation has been moved forward. This has been made possible by moving the radiator forward 8in. Although this is to some extent necessitated by the fitting of the new XK120 engine, which is longer, it has been possible also to gain something like 5in. by moving the seating compartment forward. This means that the rear seat is now practically clear of the wheel arches and there is an increase in the width of the seats.

The Jaguar Mark VII saloon.

Another noteworthy point on this body is that the luggage accommodation in the well swept tail panels, already increased by the forward movement of the seating compartment, has been made still larger by the new fuel tank arrangement. The tank is virtually halved, one section with a capacity of 10 gallons being placed at one side of the boot, and the other section having a capacity of 7 gallons being placed at the other side. These twin tanks are located behind the wheel arches and conform to the curved shape. The width over the front seats is 57in., whilst on the rear seats there is a width of 58in. The front seats are of arm-chair type and in addition to the usual fore and aft adjustment, they are also adjustable for height. A full range of interior equipment is provided and the roof includes a sunshine panel.

The external appearance of the car is striking, yet in excellent taste. The characteristic Jaguar radiator grille is retained in reduced form, and the outstanding appearance is attained by excellence of modelling and not by superimposed ornament. The front wings are of full flow type, crossing both doors and tapering to meet the rear wings and give a clear definition to the rear wing shape. The upper halves of the doors are metal framed and it is interesting to note that to achieve a door line which harmonises with the roof line, the door window frame is carried beyond the rear door hinge line. The rearward portion carries swivelling ventilation panels. Similar panels are also included in the front doors and the body is provided with a fixed V screen. A scuttle type ventilator feeds fresh air to an interior heater and de-mister, and there are also scuttle side ventilators in the wing panel immediately in front of the front



Three-quarter rear view of Jaguar Mark VII.

Jaguar Mark VII passenger accommodation.

door hinge line. The doors are hung on concealed hinges and press-button locks are fitted. In a body design that is really above reproach, there is little to suggest beyond a feeling that a shade more slope on the radiator grille would give perhaps a lighter frontal aspect and remove any suggestion of stubbiness.

Regarding the specialist coachwork exhibits, there is little doubt that in design, detail and finish, the work of the British coachbuilder remains of the highest order. Although not readily apparent in the exhibits, it is evident that the advantages of all-metal construction are becoming more widely appreciated, particularly when light alloys are used. Last year, for example, H. J. Mulliner Ltd., who have long been associated with the construction of high class bodies by traditional methods, adopted light alloy as a basic material for body framework. This year Hooper and Co. Ltd. have also turned their attention to an all-metal method of construction, employing the same class of material. Undoubtedly the emphasis on cars for use abroad under varying climatic conditions has done much to bring about this minor revolution.

Some concerns of course are fortunate in being able to concentrate upon a basic design that with minor changes, can be maintained for long enough to enable some measure of flow production to be followed. Those bodybuilders who rely upon the individual order, and they are steadily becoming less, will inevitably remain faithful to what is virtually all-timber construction. When the all important matter of weight is considered, the bodies built by such firms do not show to advantage. The performance of a car with an all-timber body can fall short by comparison with the performance of the same chassis having a body of all-metal light alloy construction.

A typical example of the ingenuity shown by coachbuilders in accommodating modern fittings and styling, was the two-door saloon coupé by James Young on a Bentley Mark VI chassis. This body is of composite construction using ash framing, reinforced with steel brackets and having steel wheel arch panels, floor and scuttle. The body is entirely panelled in aluminium and the same material is used in the construction of the wings. The front wings are carried across the doors, gradually falling and reducing in width to meet the rear wing at its junction with the bottom line of the body. This wing treatment as on most wings that pass across the doors gives an opportunity for the front door hinges to be located at the scuttle pillars and also facilitates their concealment.

In the case of this Bentley coupé, the radiator shell is moved forward 3½in. from its standard position and is slightly inclined, the bonnet being modified to suit. The door windows on this car are electrically operated. The press-button type switches are mounted in the centre of the screen capping. There are four in all, one to raise and one to lower each window.

Many coachbuilders make a practice of using metal framed door tops, these being chromium plated. They give a light appearance to the roof structure, with considerable improvement in visibility for driver and passengers. This arrangement is followed by James Young, both on the two-door saloon coupé and also on the four-door Bentley and Rolls-Royce which they exhibited. Sealing problems both as regards water and dust are frequently introduced when this arrangement is adopted, and the double seal, which is usual on fully-panelled doors, is much more difficult to provide on the metal topped version, and it is usual to use a draught welt only. Door windows have swivelling ventilators mechani-

Exceptional luggage boot capacity of the Mark VII Jaguar.

Bentley two-door saloon by James Young.

cally operated and winding mechanism that enables them to open beyond the right angle position, giving a good flow of air into the car. On this car both the doors and the boot lid are equipped with press button locks of the coachbuilders' own manufacture, and the same style of lock is also used on the interior door lining. With a two-door body in which the doors are of more than normal width, this scheme does not give the ease of control in door opening that the normal type of interor handle provides.

On the James Young Bentley the luggage boot has an alligator type lid, with a spring balance device incorporated in the hinges. This not only assists opening but also securely holds the lid when opened. In the boot the spare wheel is carried on the near side and is recessed into the rear wing, the wheel being mounted on the boot floor. A detachable carpet covering conceals the spare wheel, which is secured by a central screw.

This body has the usual de-misting devices common to Bentley and Rolls-Royce chassis, in which a blower motor draws air through a duct to the heater matrix. From the blower the warmed air is passed through twin ducts to slots in the screen capping, these slots being normally closed by a hinged chromium plated seal. The interior heater, which is a separate unit, is fitted beneath the near side front seat, passing warm air into a ducting arranged down the centre of the floor and expelling air at front and back of the seat.

The four-door Bentley sports saloon shown by James Young follows very similar lines, but has in this case a hinged quarter light, whereas the four-door Rolls-Royce saloon has no quarter light but has ventilating panels in the rear door windows, as well as in the front door windows. All three bodies are similar and have excellent proportions and lines.

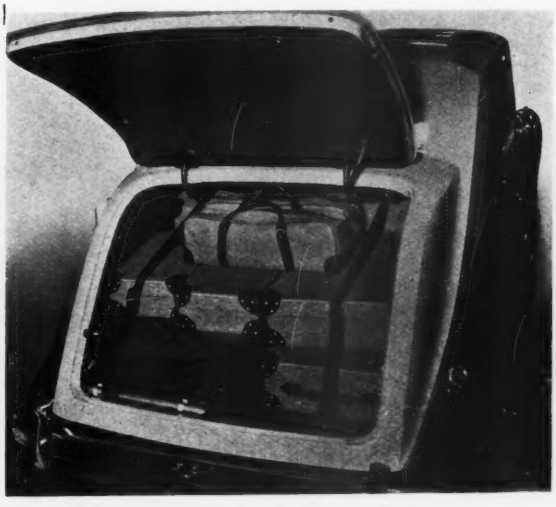
The system of the light-weight all-metal construction that H. J. Mulliner Ltd. developed and exhibited at the previous Show, was applied to a more orthodox design of body. The light alloy method of construction has, during the past twelve months, proved extremely satisfactory and rigorous tests have revealed no serious defect. The saving in weight is appreciable, and whereas the original design had a fully swept rear panel that must have simplified the building in light alloy, and also have contributed to the strength, the latest example has a rear boot of more orthodox lines. The front wings follow the prevailing style and are carried across the front door to meet the rear wings approximately midway down the lower side panel.

Both front and rear doors close on the centre pillars, and here too, the press button locks of the coachbuilders' own design merit attention. These locks are particularly easy to operate and the interior handle is exceptionally light in action. Concealed hinges are used for all doors and the formation of the rear door panel is such that it embraces a portion of the rear wing, thereby removing a dusty surface, that may contact passengers entering the rear seats. A boot lid is hinged at the top and is provided with a balance, which with the light weight lid, gives exceptionally easy operation.

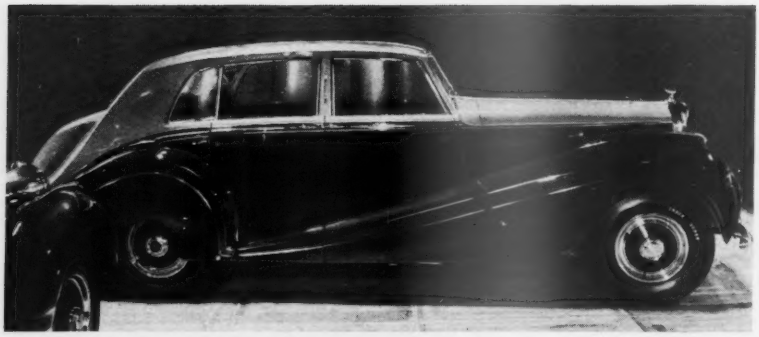
Another Bentley saloon, a six-light body shown by H. J. Mulliner has seating accommodation for five persons, and its four doors in this case also are carried by concealed hinges, closing on the centre pillars. The rear luggage boot is exceptionally roomy, the interior being fitted with specially made suit cases, and it has a lid hinged at the top. All door windows are made to drop, and both front and rear ventilating panels swivel.

The H. J. Mulliner touring limousine is a four-door six-light body shown on a Rolls-Royce Silver Wraith chassis, and in this car too, the same hinging arrangement is used for both front and rear doors. The division glass is electrically operated and the division itself is fitted with folding tables, whilst between them is a lighted refreshment cabinet fitted with cut glassware, sandwich box, etc. Accommodation is provided for five persons and the rear seat has the usual folding

Lanchester "Fourteen" luggage boot.



Luggage boot in H. J. Mulliner's Bentley.



Bentley saloon by H. J. Mulliner.

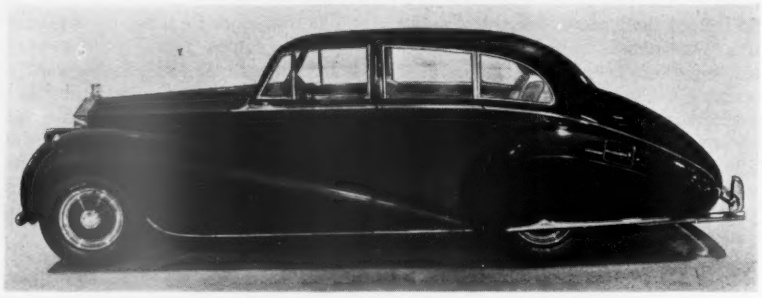
centre arm rest, whilst the driver's seat is adjustable, an arrangement that is now frequently provided in limousine coachwork.

The location of radio equipment in cars with a division is largely a matter of the customers' requirements, and in this body the radio set and controls are mounted beneath the instrument board; there is an extension speaker for the rear passenger. The usual heating and de-misting equipment is provided and the finish of this car, in royal blue and light grey with upholstery in blue leather throughout, is outstandingly good.

The panelled convertible roof extension above the front seats, commonly known as the sedanca roof, was shown on a Rolls-Royce Sedanca de-Ville exhibited by H. J. Mulliner. This type of body which presents a number of problems, has for some time been successfully engineered by this firm, who have a full appreciation of the difficulties involved, both from their own point of view and from the customers'. This de-ville extension is of the sliding type having side cant rails that fold across the body into a box formed in the roof above the division, automatically adjusting quick-release catches being embodied. Seating accommodation is provided for five passengers, and the division, which has an electrically operated glass, is fitted with folding tables. An alternative radio arrangement for a body with a division is shown on this car, the Radiomobile set being mounted in the centre of the division. In this case all the four doors are hinged on the rearward pillars, although concealed hinges are employed, and the front doors are fitted with swivelling ventilating windows in addition to the usual drop window.

All-metal body construction has been used by Park Ward and Co. Ltd. for 15 years, and their prevailing method is to erect a steel body framework which is subsequently panelled in aluminium. This Company have now had considerable experience with this method and they find it relatively easy to modify the external body shape without serious interference with the basic structure. They are not therefore faced with heavy tool and jig charges when an alternative body shape is required.

Of the Park Ward built cars exhibited, all were mounted on either Rolls-Royce or Bentley chassis, and on their own Stand the six-light saloon on a Rolls-Royce Silver Wraith chassis was an outstanding example of this coachbuilder's work. A prominent feature of this design is the full flow front wing which crosses the front and rear door to meet the rear wing near its base, and when finished in two contrasting colours this emphasizes the wing line. The body has a well swept boot and the upper line of the rear wing, together with the moulding, harmonises with this well curved line, whilst the roof also above the rear seats has rather more curvature than is usual. The parallel acting rear wheel covers that Park Ward have evolved are used on this car, and when access is required to the rear wheel, these covers are unlocked and moved rearwards. This is a good feature, since the removable cover can become damaged or sprung.



Park Ward Rolls-Royce "Silver Wraith" six-light saloon.

Another feature of this body is the disposal of the spare wheel in the luggage boot, where it is located on the near side and carried on a cam device. When the wheel is swung towards the door, it is lifted high enough to pass over the door sill and rear bumper. Seating accommodation is provided for five persons, trimming being carried out in cream leather, while the exterior finish is in black. For the driver's door an electric mechanism is used for window operation, the other three doors being fitted with the usual mechanical device. Both the ventilation panels in the front doors and the quarter windows are

Park Ward drophead coupé on a Bentley.

arranged to hinge outwards, the door windows being mechanically operated.

The two-door sports saloon shown by Park Ward and Co. Ltd. on a Bentley chassis follows a similar method of body construction and has many of the features of the Rolls-Royce saloon. This car has a green exterior finish and is trimmed in green leather with cloth inserts. A feature of the Park Ward drophead foursome coupé on the Bentley Mark VI is the plastic roof covering that is used, and this covering having a matt finish and being slightly grained to simulate leather. It is claimed that this new plastic material will not shrink and with few exceptions as to colour, will not fade, whilst its resistance to creasing has been proved by repeated tests. After the head has been folded and re-erected, the creases are at first apparent, but within a short time they completely disappear. In view of the difficulties that coachbuilders have found in securing a suitable material for the covering of drophead bodies, it is to be hoped that this plastic topping will be completely successful.

This Bentley drophead coupé is equipped with the Wilmot Breeden hydro-electric mechanism, with which Park Ward have had considerable experience. The motor and pump are mounted beneath the rear seat and are housed in a convenient recess in the chassis, the installation being provided with an interrupter switch coupled to the brake lever that permits the roof to be operated only when the hand brake is fully on.

In the case of the Park Ward body, the head when folded falls into a recess arranged behind the rear seat squab and the rams that control the head gear are fitted between the inner and outer quarter panels. This Park Ward body too has full flow wings with detachable covers over the rear wheels. An electrically operated aerial is housed in the near side front wing immediately forward of the door hinge line.

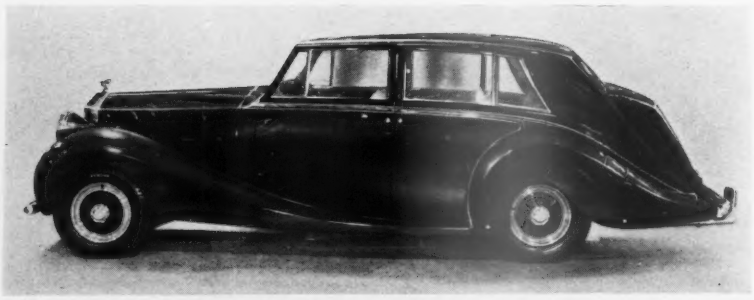
Occasional seat on Freestone and Webb Rolls-Royce.

A feature of the touring limousine shown by Freestone and Webb Ltd. on a Rolls-Royce Silver Wraith chassis, is the arrangement of the folding occasional seats, which provide accommodation for seven persons. The seats are arranged to face the centre when in use, but when folded down into the base of the division, they provide a foot rest for the rear seat passenger, the rear seat being well forward of the rear axle. The occasional seats are of minimum dimensions, and when in use there is little room between the front edge of the rear seat cushion and the rear edge of the occasional seats. On this type of car however these occasionals are only considered to give emergency seating.

Another feature of this body is the use of a plastic roof panel behind the division and there is a concealing shutter that slides forward to give the effect of completely panelled roof. This roof has another advantage for it is possible to slide forward the Perspex panel to give a sunshine roof, with free access to the air. Swivelling type ventilators are fitted to both front door window glasses, and the quarter lights are similarly arranged and are fitted with sliding inner opaque Purdah glasses. The window glasses are carried in light chromium plated channels which harmonise with the ventilator design. The interior and exterior fittings are also chromium plated.

There is ample capacity for luggage in the rear boot, which also houses the spare wheel, and there is the usual

Division on Rolls-Royce touring limousine by Hooper.

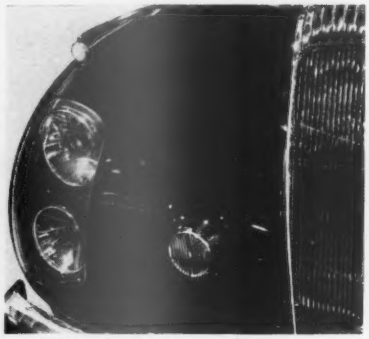


Rolls-Royce touring limousine by Hooper.

illuminated rear number plate box. The division between front and rear seats is particularly well arranged, and in addition to housing the occasional seats already referred to, there are two folding picnic tables, together with a centre mirror-backed cabinet housing cocktail requisites.

The rear door windows, division glass and rear blind are electrically operated and a press-button radio set is accommodated immediately below the centre of the instrument board, with the extension speaker behind the rear squab. Both front and rear seats are equipped with folding centre arm rests and the rear compartment is trimmed in green cloth piped in maroon hide to match the upholstery of the front compartment, with the carpets, head lining and wool rug to tone. The exterior of the car is finished in an attractive dual colour scheme, the top of the car including the waist moulding and all four wings being in maroon, with the lower body and bonnet side panels in light grey.

Freestone and Webb also exhibited a close-coupled sports coupé on a Bentley chassis, this body being of two-door four-light style with accommodation for four or five persons. The adjustable front bucket seats have a winder adjustment to alter the rake of the squabs, and there is a one-piece bench type seat. The style of trimming follows this coachbuilder's special arm-chair border design and is carried out in grey hide with contrasting piping. The interior woodwork extends to the rear of the front seat squabs and includes two folding picnic tables which incorporate self-adjusting mirrors when open. A hinged mirror is fitted inside the cubby hole, and smokers' companions are built into the quarter waist line panel, all this work being designed in one with the cabinet work. The interior lights are controlled by both manual and automatic switches, which are incorporated in the door shuts. Beneath the instrument board a press-button radio set is mounted and an extension speaker is arranged in the rear parcel tray behind the seat squab. The metal frame front door windows also combine swivelling ventilation panels, and the quarter lights also are of swivelling type, whilst a sunshine roof for further ventilation is fitted over the front seats. The exterior finish of this car is attractive, the body above the waist moulding being in grey. The moulding itself, together with the wings and lower body panels, is in red.



Headlamp enclosure on a Hooper-bodied Daimler.

Reference has already been made to the Hooper limousine which has a light alloy framework, and on the Rolls-Royce Stand this body was shown on a Silver Wraith chassis. Seating accommodation is provided for five passengers, and the driver's seat is adjustable for leg length. The rear quarter windows are hinged and the division glass is electrically operated, the front door windows being fitted with hinged panels for ventilation purposes. This coachbuilder also uses metal door top frames, and the rear door window and quarter window is divided by a single metal channel, the usual pillars being omitted. There is a large luggage boot with a door hinged at the top, the spare wheel, together with certain road tools being accommodated in a separate compartment below the boot. The front wings on this body follow a more restrained style, although they cross the front and rear doors low down and are used to conceal the running board. The rear wheels are fitted with detachable covers, which do not however continue the running board line but are upswept to follow approximately the line of the wheel rim, thus concealing the upper portion of the tyre.

An entirely new design of sedanca body on a Daimler 36 h.p. chassis was shown by Hooper and Co. and is finished in cream and black, with the rear compartment trimmed in white cloth. The front seats are trimmed in black leather and the width of the body is such that three persons can be comfortably accommodated on both front and rear seats. The driver's seat is adjustable and a fully equipped cocktail cabinet is included in the interior fittings, with radio controls in the rear seat centre arm rest.

Another Daimler chassis shown by Hooper and Co. Ltd. was the special sports 2½-litre saloon, this being a four-door body painted in two tones of green and trimmed in pale green leather piped with beige. Seating is provided for four persons and special attention has been devoted to the seating level to obtain a low overall height. A curved windscreen of Triplex glass is fitted and the fixed

The Lanchester "Fourteen" six-light saloon.

roof has been specially treated for insulation against heat.

One of the cars shown by Tickford Ltd. was a two-door four-light sports saloon on a 2.4-litre Healey chassis. In the construction of the body, the framework is of ash, specially treated to withstand tropical conditions. Aluminium is used for all body panels, wings and bonnet, and the doors are carried on concealed hinges and are fitted with chromium plated window frames with controlled ventilating panels at the forward ends. The quarter windows, which have chromium plated frames, are fixed, and the rear glass is curved Triplex. There is a sliding roof and the separate front seats, which are of tubular section, are fitted with hinged back rests to give easy access to the rear seat. The boot lid is fitted with spring-assisted joints which this coachbuilder has devised and protected.

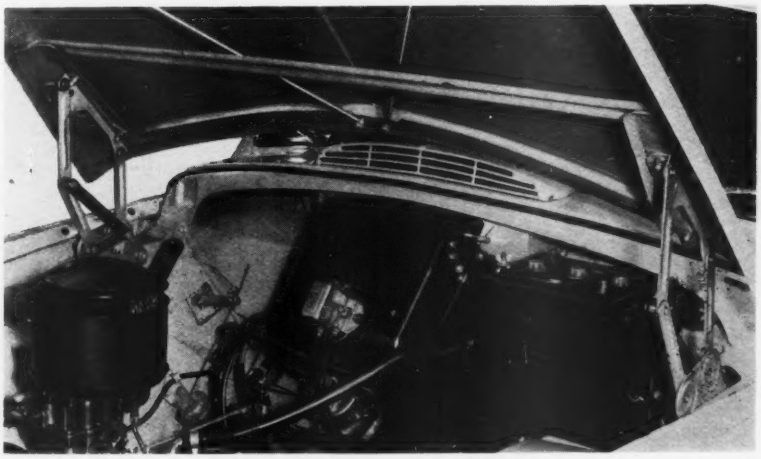
The Ford "Consul" four-light saloon by Briggs Bodies.

Side view of Ford "Consul" saloon.

A convertible foursome coupé was also shown by Tickford Ltd. on a 21 h.p. Alvis chassis, and this body combines the comfort and roominess of a saloon with the advantages of an open sports tourer. The folding head is of the three-position spring-assisted type, and the intermediate de-ville position is arranged by hinged cant rails which fold across the body. The hood folds away neatly into a recess, and so preserves the clean line of the sports tourer.

Convertible coachwork has always been a prominent feature of E. D. Abbott Ltd., who this year displayed a drophead coupé on a Bentley Mark VI chassis, and also a similar type of body on a 2.4-litre Healey chassis. In most respects the Bentley coupé is similar to the body exhibited last year, having the prevailing full flow front wing passing across the doors to merge into the rear wing approximately half way down the panel. On this coupé the Wilmot Breeden hydro-electric actuating gear is used, and for the headwork, the contracting device is that embodying a cam against which the pillar face bears. The folding pillars are contracted as they fall and are thus able to pass down on the inside of the elbow rail. There is a large luggage boot with the lid opening upwards, in which the spare wheel is housed on the floor towards the near side. The head lamps are recessed into the front wings, where incidentally they are not really adequately protected by the bumper.

Two rather unusual bodies were shown by Rippon Bros. Ltd. on Bentley and Rolls-Royce chassis, these bodies being styled Continental touring saloons, and bear some resemblance to the popular utility vehicle. They give seating accommodation to five or six passengers and there is of course ample accommodation for luggage. The room available in this utility type vehicle makes possible a large folding table at the back of the front seat, and there are folding arm rests to both front and rear seats. The exterior finish is in ivory, with chromium plated moulding at the



Bonnet hinges on the Nash "Rambler".

waist, and the trimming is carried out in tan pig-grain hide.

Regarding the bodywork on car manufacturers' vehicles, the two new Ford models constitute a very distinct break away from the conventional and somewhat out-moded styles that have characterised this important manufacturer's low horse power products since the war. These two new models, known as the Consul Four and the Zephyr Six, are typically modern in appearance, and although the integral wing and body side panel design feature is used, there is little doubt that the appearance of these cars will meet with wide approval.

The two bodies are similar in interior dimensions, but to accommodate the larger engine, the Zephyr has a different bonnet styling and length, and the overall dimensions of the car are greater. Particular attention has been devoted to the matter of visibility, and both the windscreen and the back light are of exceptional size, and give a feeling of comfort and safety which is fully appreciated when seated in the car.

The bodies have four doors and four windows, with ventilating panels at the front end of the front door windows. The body and chassis follow the unitary method of construction, the welded steel structure being suitably arranged to facilitate the attachment of mechanical units. The base structure is reinforced with U-section pressings over the rear axle, and at the front, box section forward extensions are used to support the engine. These extensions vary in length to suit the four and six cylinder power units. Rigidity is assisted by the combination of windscreen frame, one-piece side pressings which form the door apertures and the roof panel. The bulkhead dividing the engine compartment from the scuttle, together with the valance plates at the side of the engine and the front bulkhead, complete the structural strength of this car.

The Austin A40 sports model.

The doors are hung on the front pillars, the accommodation of the hinges being simplified by the increased thickness of the pillars below the waist

Bonnet vent on the Austin A70.

rail. Rotary pattern door locks are used, and the boot lid which is of exceptional width, is carried by spring loaded hinges, the boot lid opening upwards. The number plate lamps are carried in the centre of the boot lid and when the lid is raised, these lamps show a light to the rear. Against the off side inner panel of the boot, arrangements are made for the accommodation of the spare wheel, the depth of the body at this point being such that the wheel is carried in a vertical position.

For a car of these compact dimensions, the width within the body is exceptional and the best use has been made of the 64in. overall width. The front seat is of single piece style, with the usual fore and aft adjustment, whereas the rear seat, being located well in front of the axle, loses little in the way of width due to the wheel arches. The wheel arches in fact only slightly reduce the width of the squab at the base, and all seats are well between the front and rear axles.

The layout of the instrument board is interesting, there being behind the curved windscreen, a panel running square across the body between the front door hinge pillars. This panel is rounded towards the top, giving a ledge varying in width according to the sweep of the screen. In the centre of the vertical face above the various switches, which are arranged along the bottom edge, a radio control is fitted, this being an optional extra.

At either side of the central arrangement there is in effect a clover leaf design, which to the near side outlines the cubby box door, and to the off side immediately above the steering column accommodates an instrument board carrying a speedometer, a fuel gauge and ammeter. Another point about the front compartment is that the clutch and brake pedals do not operate through the floor, but are suspended from a common centre located in the upper portion of the bulkhead. An alligator type bonnet is used and is carried on a lazytong hinging arrangement which lifts the rear edge of the bonnet well clear of the scuttle and also brings it forward at the same time. Fresh air ducts leading from the front of the car are built into the front end,

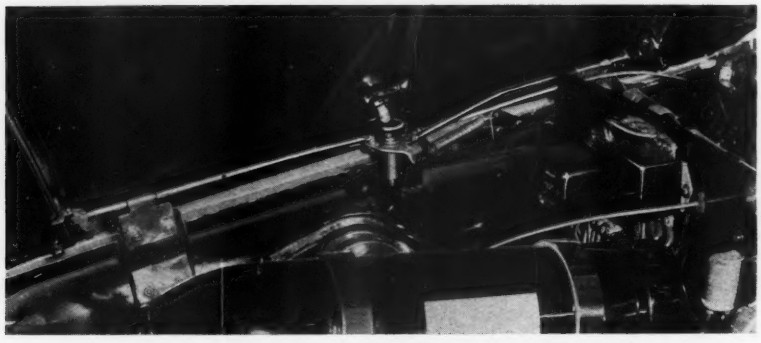
The re-styled Austin A70 four-door saloon.

and a heater unit is available as an optional extra. The equipment of the body includes traffic signals, ash-trays and sun visors.

A new sports car based on what has become a popular saloon model, is the Austin A.40 open four-seater, which besides providing a small open sports vehicle that has so far been lacking in the post-war Austin range, also introduces a new front end styling for this popular model.

The bonnet top panel is of the alligator type and is carried by visible hinges fixed on the scuttle top panel. The front end of the car has been considerably altered, the grille admitting air to the matrix being of reduced height and virtually oval when viewed from the front. The grille consists of horizontal chromium plated slats, and since no chromium plated surround is used, the front end is quiet and unobtrusive.

Clean lines of the new Triumph Roadster.



Triumph Roadster bonnet hinging arrangement.

The front and rear wings form the body side panels and there is no reduction in width for their entire run. Since, however, there is no relief on these side panels other than mouldings above the front and rear wheels, they are somewhat lacking in character. The folding head when lowered is concealed in a recess behind the rear seat and there are detachable side panels to conceal the hood fitting when the hood is down. When the hood is erected, additional ventilation can be provided by releasing the rear panel which is secured by zipp fasteners. In the well swept tail there is considerable luggage space, and access to this compartment is through an alligator type lid, the spare wheel being carried in the boot in the horizontal position.

Another Austin model that has been slightly modified is the A.70 Hereford saloon, which now has a somewhat Continental appearance with a horizontal grilling extending to the forward face of the front wing. These serve a definite purpose in permitting air to pass for ventilation and also for cooling the front brakes. The bonnet line is lower and improves the forward visibility. This new model has increased interior dimensions, and additional leg room has been obtained by increasing the wheel base. An additional 3in. in width is also given, the width over the front seat being 53in., and over the rear seat 52in. There are no obvious bonnet side panel ventilation outlets, but the Austin name plate is of elliptical form and is pierced to provide an outlet for fumes from the engine compartment. A drophead coupé is also available on this chassis and the lock operation from the exterior of the car is effected by a sunken finger plate in the upper face of the waist rail.

The new Triumph embodies a number of features that have in the past been associated only with specialist coachwork. The new car is a two-three seater Roadster, the whole conception and modelling being completely different from that of former Triumph models. The bonnet and front wing panels are given considerable curvature and are virtually one unit, the upper bonnet panel having a hinging arrangement that permits the panel to be raised from either side, although there is no centre hinge.

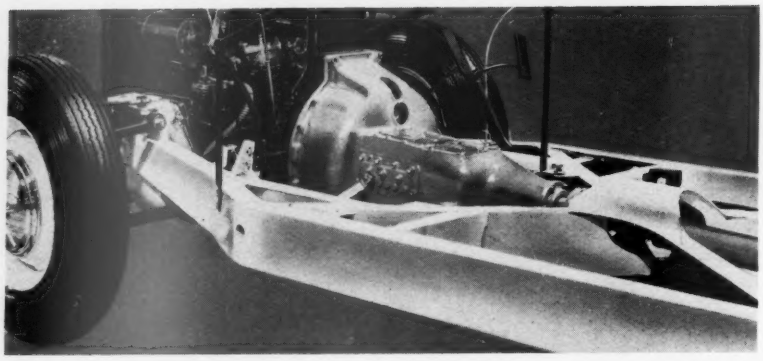
For the operation of the folding head the Wilmot-Breeden hydro-electric equipment is used, and by the same means the door window glasses are operated. The head lamps are let into the front wings and have concealing covers actuated by an electric motor. When the head lamps are switched on, the motor is simultaneously actuated. This car is very well equipped and includes a vacuum operated radio aerial housed in the near side front wing immediately in front of the door.

Luggage boot of the Triumph Roadster.

FRAMES

Light Weight with Stiffness, the Prime Objectives

INTEGRAL chassis and body construction is gaining ground on small and medium size cars, typical newcomers being the Ford "Consul" and "Zephyr" cars and the Fiat 1400. There appear to be two schools of thought, one considering the body sills as the main side members and the other basing the design on a frame of more or less normal width with out-riggers welded to the integral body sills. The Hillman "Minx" may be regarded as an example of this practice, its basic frame being quite adequate to take a separately mounted body.



Frame bracing on the Lanchester "Fourteen".

In the Morris "Minor" the body sills are the main longitudinal members and are connected to the narrower out-riggers carrying the front suspension and engine by running these some way past the sills and coupling up with two cross members.

Rear end of Lanchester "Fourteen" frame.

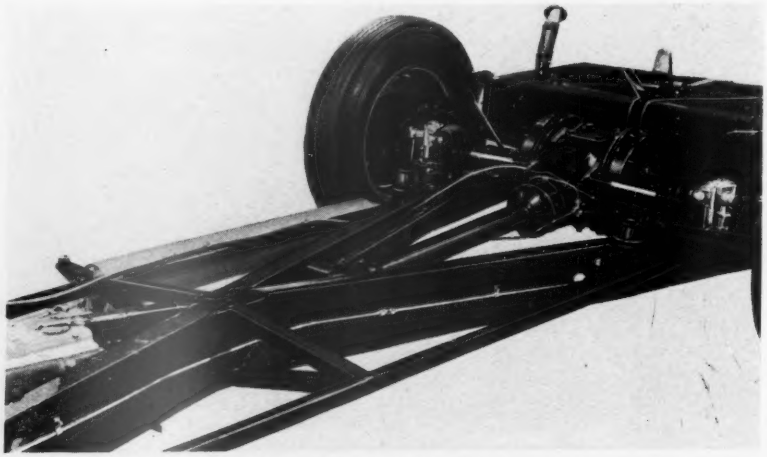
The new Fiat 1400 has a basic frame, narrow at the front and then sweeping out sharply to form the body sills. This is reinforced by diagonal struts running down from the scuttle, the ends of which join the front door pillars the lower ends of which are in turn welded to the sills just at the beginning of the curve. This reinforcing, coupled with the welding on of the integral floor sheets makes a complete success of a design which, considered as a frame, would be undoubtedly weak at the inswept portion.

Box section is, of course, always employed in integral construction and is becoming popular in the separate scheme. At one time, the windscreen pillars, roof and centre door posts formed a most valuable part of the integral body structure. Thin windscreen pillars and the popularity in America of the "hard-top" coupé, which has no intermediate door pillars, makes the stiffness of the structure largely dependent on what comes under the floor sheets.

Separate frame design, while directed to lightness combined with stiffness against bending and especially resistant to torsion evidences some variations. The Austin A40 frame, for example, has box-section side members and only two straight cross members, a massive one for the front suspension and one at the extreme rear. In between there is diagonal cross bracing which has short cross pieces spanning the outside panels to give additional support to the frame side rail where the body out-riggers are attached.

The frame of the Rover 75, on the other hand, has no diagonal bracing at all, but very large box-section side members and five large box-section cross members. The Sunbeam-Talbot has box-section side rails and I-section cross bracing made by tack welding web plates to flange strips. This, as is well known, gives definitely more stiffness than a channel pressing, in which the flange metal is off the centre-line of the shear material in the web.

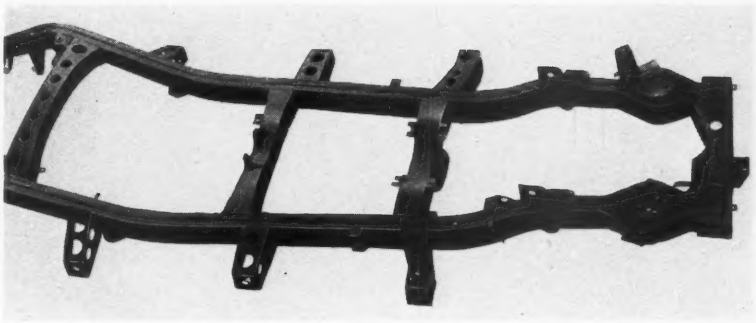
The Lagonda frame, while possibly rather expensive to produce, is a very fine piece of design. It may almost be regarded as a hefty cross-bracing with a few attachments. The point is that



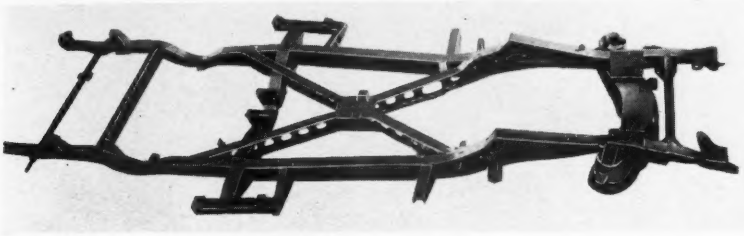
Main X members of the Lagonda frame.

the designer has deliberately intended the cross bracing to take the whole of the bending stresses. This is perfectly right because if a long cross bracing is intended to take the strains set up when the frame is momentarily supported by two opposed corners, one of the cross-bracing members has at that moment to take the whole of the bending strains. The side members are at that instant completely valueless in this respect.

On the Lagonda frame the cross-bracing is of I-section made by spot welding two channels back to back and seam welding cover plates to their flanges. The bracing runs almost to the axle centre lines and is tied by two longitudinal tubular side rails tied to the centre by out-riggers from the crossing point. The ends of the frame are completed by short sections running parallel and bracketed to the diagonals. The custom-built bodies are attached by conical rubber mountings.



The Rover "75" frame by John Thompson Motor Pressings.



Sunbeam-Talbot "90" frame by Rubery Owen.

Another interesting frame is the Aston-Martin. This is built up of relatively small square section tubing, the side rails being of varying depths and consisting of two superimposed tubes tied together with vertical tubes and spacers. The structure becomes quite deep in the region of the scuttle and the principle seems to be an excellent one for the small scale production of a very stiff frame where cost is not of prime importance.

BRAKES

Continued Developments of Existing Layouts

THOUGH the brakes on the American cars evidenced no changes over last year's exhibits, it seems likely that drastic changes may be impending. The increasing power and speed of American vehicles, coupled with limitations on brake-drum diameter are arousing interest in improved systems. This interest is intensified by the increasing popularity of torque-converter transmissions, on many of which the engine is, at times, of little value as a brake. Though not shown at Earl's Court, a disc brake, on the lines of those evolved in Germany during the War, has been developed by Chrysler and is now in production. The cars exhibited are still equipped with the same brakes as last year's models.

The Bendix Duo-Servo is probably the most popular in the U.S.A. this having two shoes linked together by an adjustable strut and spread by a double-acting hydraulic cylinder. The rear shoe butts on an anchorage, while the front shoe is pushed forward and its drag acts on the tip of the rear shoe to give a servo action. This is so powerful that it has, in practice, to be kept down by the employment of linings with a specially low coefficient of friction.

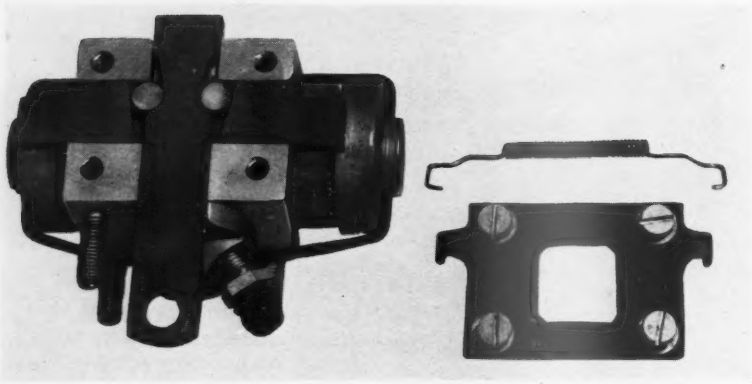
Other firms use the two-leading shoe system, called "two-cylinder" in America, either with floating shoes, as we understand them, or with shoes having hinged anchor struts. These give the same effect with the additional advantage that the struts, being frictionally part of the shoes, carry the heels of the shoes well away from the drums when the brakes are released. A floating shoe of orthodox type only gets its heel clearance as a result of being knocked back by drum movements due to axle shaft deflections and vibration.

All the new American cars with torque converter transmissions have provision on the gear control lever for locking the transmission with the gear in neutral by means of a pawl engaging a toothed wheel on the transmission output shaft. As a result the hand brake, though still fitted to comply with the law, is hardly ever used for parking the vehicle. Since the torque converter transmissions have no clutch pedal the driver can use the left foot to apply the brake, and on the Studebaker car exhibited, the brake pedal is especially wide to make left-foot operation easier.

The final result of this state of affairs may be to discourage the use of brakes that do not hold equally well in both directions. The 2.L.S. front brakes doing 60 per cent. of the forward braking and next to nothing in hill-holding, may become unpopular, once restarting on a hill on the footbrake becomes a recognised procedure. That the existing type of facia-mounted pistol-grip handbrake leaves much to be desired is shown by the fact that Buick replace it by a pedal-operated lever released by pushing a knob with the finger.

Another problem arising from the popularity of the torque converter is that of involuntary "creep" owing to the drag of the converter, especially with a cold engine still running on a "fast idle". To obviate the necessity of keeping the foot on the brake pedal the Studebaker Co. fit a ball-valve in the hydraulic brake system which, when the foot brake has been applied and the vehicle is at rest, holds the brake on until the accelerator pedal is slightly depressed. If left-foot braking is to become standard this refinement would be almost superfluous.

With the single exception of Vauxhall Motors who use Lockheed hydraulic equipment but their own shoes with hinged anchor struts, all the brakes on English cars are either

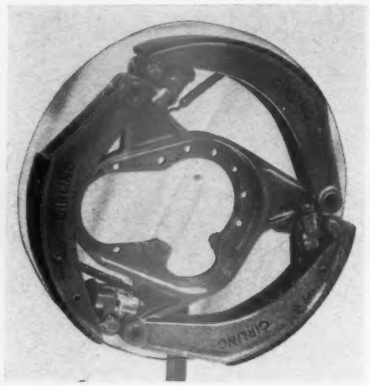


Wedge and roller expander on Girling hydraulic rear brake.

Lockheed or Girling. With one important exception, all the new brakes have floating shoes, Lockheed favour a parallel abutment which means that the lining comes close to the heel of the shoe, while Girling set their abutments at an angle, which permits of the lining being kept further away from the anchor point. It was hoped that floating shoes would cure brake squeak, but this is not fully borne out in practice. Lockheeds have made a great improvement in this respect by slotting the webs of the shoes to about two-thirds of their depth at a point about a third of the way from the toe of the shoe. This modification is now standard on all Lockheed brakes, and precise instructions are issued to service depots so that the notches may be correctly cut in existing brakes. The position and depth of the notch is critical and it is hoped that no garage will interfere with an excellent brake, as a result of reading these notes

There being no other modifications this year, the Lockheed Co. have concentrated on standardizing every detail of their brakes. A range is offered in 1in. steps between 7in. and 12in. in diameter, two leading shoes at the front and floating cam-type at the back. Only two sizes of wheel cylinder are used, $\frac{7}{8}$in. and $1\frac{1}{8}$in. respectively, and two master cylinders $\frac{7}{8}$in. and 1in. Many of the small components are common to a wide range of sizes and all are designed to give a 60/40 ratio between front and rear braking.

The Girling hydro - mechanical brake, in which both foot and hand operate the rear shoes by the same rod work, is still very popular. It is fitted, for example, by Austin, Riley and Lanchester, but there is some demand for an all hydraulic Girling brake. This has been met by a design in which the normal double-acting wheel cylinder is provided with crossed rectangular recesses taking a flat expander with wedge notches that engage rollers bearing on the ends of flat section plungers. The whole is retained by a steel cover plate and is located in the small space between the cylinder and the inside of the brake drum. Since all the expander parts



Girling three-leading-shoe brake for the B.R.M.

can be blanked from flat strip, the cost of production should be low.

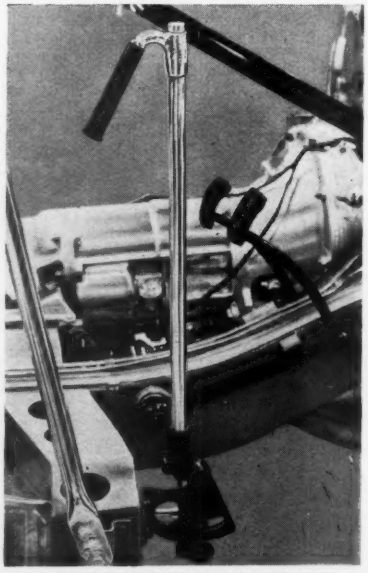
An interesting exhibit on the Girling stand was the special brake developed for the B.R.M. racing car. This has three leading shoes made as aluminium alloy castings with double webs anchored on pins, applied by three equally spaced hydraulic cylinders and adjusted by snail cams. The proportion is such that the leading shoe servo action is only moderate, the aim being more to get exceedingly consistent braking rather than great power.

Another interesting brake shown on the Girling stand was the two-trailing shoe front brake, being developed for the Jaguar Mark VII car. The shoes here are anchored and the brake is intended to be operated by a vacuum servo which Clayton-Dewandre are making. The object is, of course, not power, this being provided by the servo, but exceedingly consistent operation free from shudder and fade. As both shoes are trailing, the co-efficient of friction of the lining has far less effect on brake performance. Provided a compact, economical, and delicately sensitive servo can be made, the system should be widely employed.

It is interesting to note that the two leading shoe brake has not made much headway in the Continental market. The new Fiat and Lancia cars, for example, have hydraulic front brakes of the floating cam type, with die cast shoes, each anchored on its own pin with adjustment by snail cam clearance stops. The Fiat 1400 continues the previous practice of fitting the hand brake on the transmission. On the Fiat 500 the brake is at the back of the gearbox. On the 1400 model the contracting band brake works on a small drum on the bevel pinion shaft in the back axle. There seems no objection to this arrangement, as the hand brake is never used now-a-days as an alternative, but only for parking purposes and restarting on a hill. For this latter purpose, a transmission brake is far easier to operate, owing to its increased leverage. It has an incidental advantage that if the driver is a little bit late in releasing the brake, the stresses caused by letting the clutch in violently on bottom gear are confined to the gearbox and propeller shaft and are not imposed on the differential assembly and axle shafts.

Aluminium alloy drums with shrunk-in cast iron liners are used on several of the more expensive cars, particularly those intended for high speed competition work.

The new 14 h.p. Lanchester, which has Girling Hydro-mechanical brakes, has bell cranks and a strut fitted to one shoe in each rear drum in order to give a two-leading-shoe effect on the rear



Hand-brake lever on the Rover "75".

brakes in addition to that at the front. An extra set of struts and bell cranks could give a two-leading-shoe effect in a rear direction and assist in holding the car on a hill. As it stands the car has brakes which are remarkably efficient in a forward direction but, by comparison, are inefficient in the backwards direction.

Hand brakes are not improved by the use of cable mechanism turning through 180 deg. and wasting about 40 per cent. of the effort in friction. The Austin firm are to be congratulated in not employing this mechanism. Instead, there is a long upstanding lever under the bonnet to which the pistol hand grip is directly connected. This year the Rover car has a plain upstanding hand lever with a walking-stick type of grip turned downwards to the rear, and a pawl release by a knob on the top of the vertical lever, a highly commendable arrangement.

ELECTRICAL EQUIPMENT

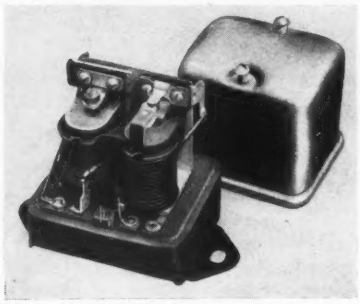
Minor Advances and Detail Improvement

THE fact that there does not appear to have been any spectacular change in the design of electrical units during the past year does not indicate that progress is at a standstill. A question that does arise is "In what direction do we expect or need improvement?" If we consider particular instances we find that the present requirements are quite well met by existing designs. There are of course exceptions, of which probably the most obvious are starters and batteries. The electrical design of starters does not admit of much criticism, but the drive and method of engagement is far from ideal. The fact that it is low in cost and reliable is the chief recommendation. Improvement could undoubtedly be made but questions of cost immediately arise, and commercial considerations prevail.

Lead acid batteries are in a rather different category as the life is determined both by chemical and mechanical considerations, and these are closely linked together. We have become accustomed to the low power to weight ratio and the continuous fall in capacity with use and age. World shortage of lead may stimulate research in some direction which is not yet evident.

Dynamos

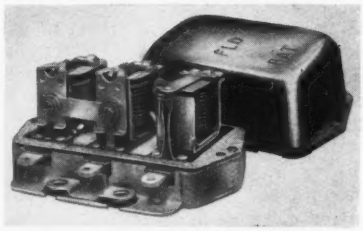
The needs of the majority of the British cars appear to be adequately covered by the two standard models made by Lucas. The outputs of both these machines, however, have been increased so that the 3.9in. model will now give 19 amperes against the previous 17, and the 4.5in. diameter unit 22 amperes instead of 20 amperes. This increase has been made possible by improved cooling, as the maximum current a dynamo can deliver depends to a large extent on the permissible temperature rise inside the machine. In the new models the basic design remains the same, but the ventilation has been improved by fitting slightly larger fans which are located, as before, immediately behind the driving pulleys.



Lucas regulator unit R.B.106.

Air is drawn in at the commutator end through holes that are shaped to direct the stream on to the commutator and brush gear, after which it passes through the windings of the machine and out through the fan. The fan diameter is now 4½in. for the 3.9 dynamo and 5in. for the 4½in. machine. As the fan is in each case right up against the driving pulley, the space required for installation is hardly affected.

The Lucas RA.9 type dynamo is unchanged and continues to be fitted to Rolls-Royce and Bentley cars. It is completely enclosed and is very silent in operation. All British cars exhibited, with the exception of the Ford "Anglia" and "Prefect", are fitted with 12-volt systems, compensated voltage control being used in all cases. The new Ford "Consul" and "Zephyr" models have 12-volt Lucas equipment. American and Canadian cars all use the 6-volt system and the dynamos have outputs of from 35 to 45 amperes. In the Auto-Lite equipped models which include the Chrysler group, the Packard and the Kaiser, there appeared to be three dynamo sizes with outputs of 35, 40 and 45 amperes. In some cases these sizes were alternative. The Delco-Remy equipment fitted to the General Motors group, the Studebaker and Nash, has similar characteristics and the reason for the alternative outputs is not obvious.



Auto-Lite current-voltage regulator unit.

Control Boxes and Fuses

Two new designs of control boxes, models R.B.106 and R.B.107, have been introduced by Lucas. They have many points of similarity, both being small and compact as they do not carry any fuses in addition to the voltage regulator and cut out. The R.B.106 illustrated, is an advance model and not necessarily identical with the production model which may not be available for several months. It is intended that this shall become the standard for average cars and light commercial vehicles and will be supplied to the manufacturers as it becomes available. The R.B.107 is like the R.B.106 in many ways, the chief difference being that it is suitable for fitting in exposed positions, as it is both dust and waterproof and also more proof against rough usage. The Auto-Lite control box shown is of interest, and it also contains the control units alone. In this case, however, there are three units as combined current and voltage control is almost universal on account of the heavy currents of 6-volt systems.

Most of the British and American cars now have the positive earth system and the fuse in the charging circuit is now omitted in all installations. Separate fuse boxes mounted away from the control boxes are now employed and Lucas show a separate two-way fuse unit of very simple construction designed to work in conjunction with their control boxes. As control boxes rarely require adjustment, there is no need for them to be readily accessible and the most suitable positions for both control units and

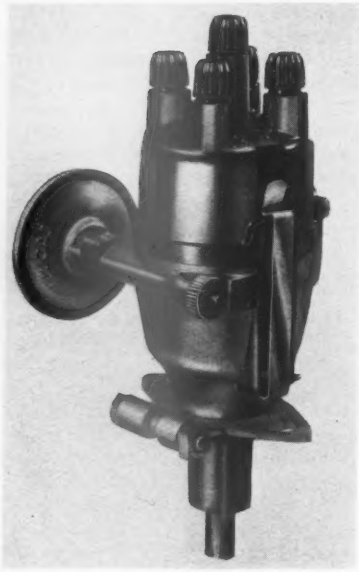
fuses in relation to their functions can be chosen. For instance, it may now be possible to locate the battery and regulator so that they operate at the same ambient temperature with advantage to both battery and dynamo.

Coil Ignition Equipment

A new range of distributors was shown by Lucas, comprising three basic models, two four-cylinder types and one six-cylinder type DM6. One of the four-cylinder models and the six-cylinder model illustrated have the vacuum operated timing control built into the body in addition to the usual centrifugal mechanism. Particular attention has been paid to the bearing design in these models in order to obtain the longest possible life. The six-cylinder model has a hard cast iron shank in which the drive shaft runs, with oil mist lubrication for the lower part, an oiler being fitted for the upper part. As a result these new distributors are claimed to be very silent in operation and, owing to the improved bearings and consequent reduction of side play in the shaft and contact breaker cam, the accuracy of the ignition timing is maintained within close limits. The contact breaker base plate moves on a special bearing assembly about the driving shaft, as determined by the vacuum control, and a new centrifugally operated mechanism of improved design is housed in the base of the distributor in the usual way. As both the vacuum and centrifugal mechanisms are completely enclosed in the unit, they are protected from dust and dirt. A micrometer adjustment is provided for setting.

The condenser used in this new range of units is of the metallised-paper type, the paper having deposited on it a very thin layer of metal. It is claimed that should the condenser break down, the metallic film round the point of rupture is vaporised by the heat of the spark, so preventing a permanent short circuit and making the condenser self healing. This method of construction permits the use of impregnating wax with improved high temperature qualities. As a rubber seal and flexible connector are used, these condensers should last indefinitely even in the tropics.

Contact breaker and condenser of Lucas ignition head type DM6.



New type Lucas ignition head.

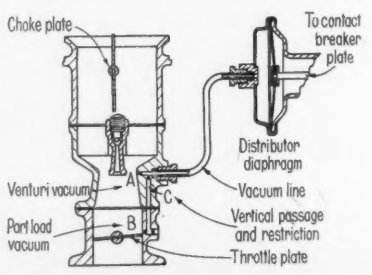
The distributors fitted to American cars do not appear changed, and it is interesting to note that even with the straight-eight engines a single pair of contact breaker points operated by an eight-sided cam continues to give satisfactory performance with standard coils. Even with the high compression ratios now employed and the wide speed range of the engines, a gap setting about 40 per cent. wider than in British cars is used for both contact breaker and plug points. The large V-eight engines continue to use a separate distributor for each bank of cylinders. Wide gap settings are used in these cases also.

In the "Loadomatic" system of ignition advance shown on the Canadian-built Ford, no centrifugally operated weights are used to control the point of ignition. The distributor shaft is made in one piece so that the contact breaker cam cannot move relatively to the drive shaft, the whole of the advance motion being obtained by partial rotation of the contact breaker plate assembly which carries the two contact points and their condenser. The angular position of the plate is controlled from the carburettor by a vacuum diaphragm through a rod linkage as in the usual vacuum advance mechanism, and operates against light springs that tend to bring the plate back to the initial or fully retarded position. The depression in the diaphragm chamber determines the angle of advance and is controlled by the degree of vacuum at the venturi section of the carburettor and also by that at the edge of the throttle plate.

The general scheme is shown in the accompanying illustration from the *S.A.E. Journal*. It will be seen that the carburettor body is drilled at the throat A and at the throttle B, the holes being connected together and the resulting vacuum transmitted to the diaphragm by a small pipe. The sizes of the holes are restricted at A and B and there is also a restriction C in the passage connecting the two holes. The vacuum at the diaphragm under various conditions of speed and load is determined by the relative sizes of these restrictions. The vacuum at A is a function of the air flow through the carburettor and is related to engine speed on full load so that the effect if transmitted to the contact breaker plate would be comparable with that of the usual centrifugal mechanism. The vacuum at B is related to the manifold depression so that the effect is similar to that of the ordinary vacuum advance.

Both these effects are modified by the restriction C in the connecting passage. This restriction, together with the restriction at either A or B, acts as a bleed on the remaining hole, tending to modify the resulting effect. The sizes of these restricted holes, together with the spring attached to the contact breaker plate, determine the form of the ignition advance curve.

In the accompanying diagram, the throttle is almost closed, as it would be under idling conditions. The manifold depression is inoperative owing to the position of B, which is behind the throttle plate. The depression at A is also negligible so that the contact breaker plate is pulled round to the fully retarded position by the spring. At small throttle openings, particularly with low engine speeds, the depression at B will be very much greater than at A and will largely control the angle of advance, though bleeding from A to B will occur and modify the effect. At full throttle there will be greater



Vacuum ignition control on the Canadian Ford.

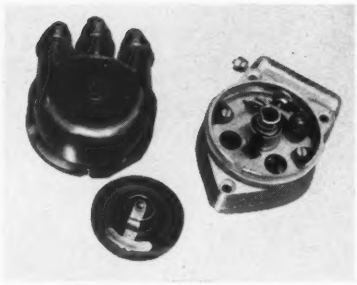
depression at A than at B and the depression will increase with the speed, though bleeding from B to A will occur. If the throttle opening is reduced in stages, the bleed from B to A will be correspondingly reduced with the effect of increasing the advance. This action will continue until the direction of the bleed is reversed and as engine speed falls, the previous conditions are repeated.

A variety of distributor heads were shown, the principal makers being B.T.H., Delco-Remy, Auto-Lite and Scintilla. These have been referred to previously and are all of the centrifugal type with vacuum advance in addition in most cases. Ignition coils were shown by all the above makers and also the oil-cooled model made by Runbaken. Delco-Remy have a new high efficiency coil which is small and compact for its power. The new Scintilla B.R.A.2 distributor head for small two-cylinder engines is remarkable for its small size and compact design. The automatic advance mechanism is housed in the recess at the back of the plate forming the base of the machine and carrying the moulded head with its two plug lead sockets. The unit is designed for bolting directly to the vertical face of an engine so that its camshaft can be coupled to one member of the advance mechanism. The general scheme is a very much simplified version of the Vertex mechanism, two centrifugal weights only being used. The driven shaft carrying the contact breaker cam has a two-lobed cam at its other end. These two lobes each engage with a recess formed near the pivot of each weight. Outward motion of the weights move the driven shaft forward, giving the ignition advance. The two weights are each controlled by a spring, the strength of which determines the rate of advance. The cam is partly enclosed and is lubricated by an oil pad.

Magnetos

Progress continues with magnetos for special purposes, though there is no indication of their adoption as standard car equipment. The vertical models shown by B.T.H., Lucas, Scintilla and Wipac are unchanged. The Lucas S.R. model referred to last year as a single cylinder machine, is now available for two or four cylinder engines. The general design is unchanged and no advance mechanism is fitted.

Scintilla show two extremely compact designs. Type N.C.A.1 is a single cylinder machine designed for bolting directly to the side of an engine, the shaft of which should be tapered to carry the magneto cam and

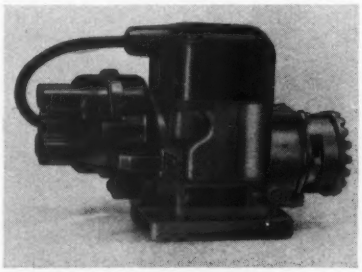


Scintilla distributor type B.R.A.2.

rotating magnet. In the case of a two-stroke engine, the mainshaft would carry the cam, on a four-stroke the camshaft would do so. A two pole rotating magnet is used and a single cam and contact breaker, so that one spark per revolution is provided. Slight adjustment in setting is arranged for by slotting the bolt holes in the mounting flange.

The Wipac magneto illustrated is typical of the "Series A" machines, which all include the same central basic unit, various models being produced by assembling suitable components to this unit. The example exhibited had base plate mounting, but flange mounting can be obtained by fitting a standard flange and omitting the base plate. The design of the parts and the manufacturing limits are arranged so that the dimensions of any complete machine are in accordance with the standards laid down for that model.

The machine is designed on the rotating magnet principle, the coil consisting of the primary and secondary winding being located above. The pole pieces of the machines are formed of soft iron laminations which are cast into the frame and extend upwards to carry the coil unit which is mounted on its own core. This core completes the magnetic circuit and all contact faces as well as the pole faces are ground to minimise the reluctance of the flux path. An impulse coupling is usually fitted to these machines and there is no spark advance lever. The usual ignition setting is 20 deg. before the top of



Wipac "Series A" magneto.

the stroke, the impulse gear retarding the spark to the top of the stroke for starting. It automatically cuts out on reaching about 165 r.p.m.

Interference Suppression

The need for preventing interference with radio and television reception by the ignition system is now very definite, and on the majority of cars adequate suppression can be obtained by fitting a single resistance at the distributor end of the high tension lead from the coil. In some cases, however, where the position of the leads gives less screening, resistances are required at each sparking plug as well. In the new distributors referred to, the carbon brush carrying the high tension current from the coil to the rotor arm is of composite material, having a high resistance. To prevent undue wear of the rotor arm contact, the brush is tipped with softer carbon.

It is claimed that the fitting of resistances in the sparking plug leads increases the life of the plug points as it reduces the capacity component of the spark discharge which is the major cause of point erosion. Joseph Lucas show a range of suppression capacitors for cars having radio sets installed. In addition to the ignition circuit, the usual sources of interference are those where a current flowing in an inductive circuit is continually interrupted, such, for instance, as the commutators of the dynamo and screen wiper motor and perhaps also the primary current of the ignition coil. This kind of interference can be prevented by connecting a capacitor across the unit concerned, which generally means earthing one side through a capacitor.

Starting Motors

The inertia engaged drive is universal with a very few exceptions in which the pinion is brought into engagement before the current is applied. Battery operated relays are more generally used and more attention is being paid to reducing the length of cable to the starter.

Headlamps and Fittings

The Lucas Light Unit type of headlamp designed for flush mounting is the standard fitting on nearly all British cars and is similar to the Sealed Beam unit fitted to all American cars. The Light Unit construction employs a reflector and front glass permanently fixed to each other, the reflector having an aperture at its apex to receive the bulb. The two filaments in the bulb are located with considerable accuracy during manufacture, and as the bulb

can only be fitted in one way, correct focusing is ensured. The required distribution of the beams is obtained by means of flutes or small lenses formed in the front glass as before, but has now been carried a stage further by the introduction of the "square pattern lens". This lens is divided into about 160 strips, 1in. high and ¼in. wide, each of which can be fluted to spread the light or formed as a prism to bend it as required for either the driving or the dipped beam.

Both filaments are horizontal and placed at right angles to the axis of the reflector, the driving filament being at the focus and the dipped filament 3 mm. above it and offset to the right by about half its length. In the dipped position both headlamp beams are in consequence deflected downwards and to the left. In the 12-volt standard bulbs the filaments are of the single coil form rated at 42 and 36 watts for the driving and dipped beam respectively. A comparatively long filament is unavoidable with the single coil construction, and it will be interesting to see whether the upper filament will sag sufficiently towards the axis to cause glare in the dipped position. The system complies with the requirements of the Geneva Convention and will be fitted as standard equipment on British cars.

The vacuum type of screen wiper is still fitted to the majority of American cars, probably because it is silent in operation and, with the addition of a fitting such as the vacuum pump incorporated in the A.C. fuel pump, it is powerful enough to deal with hard winter conditions. There appears, however, now to be a tendency towards electrically driven wipers, examples of which were fitted to the Buick and the Kaiser de Luxe. These were both two speed models and the blades were automatically parked by switching off.

Most British cars are still fitted with the Lucas cable-rack electric wiper, and the firm is now introducing the F.W. model for mounting on the screen itself if required. This replaces the old C.W. type and is fitted with a more powerful motor than before. It is said to be smoother running and quieter than the old pattern and to have twice the torque. It is interchangeable as regards fitting dimensions with the C.W. type.

Heating and Ventilation

There is no doubt that some form of car heating equipment has now come to be regarded as essential, and in all but a few of the smallest cars provision is made in the body design

Lucas headlamp model F.700 with square pattern lens.

to receive the installation. For example, all the new Morris Minor cars are fitted with ducts behind the screen to which pipes from the de-misting part of the heater can be connected when installed. Heating equipment is still far from standardisation either as regards the design of the units or the method of installing, but car manufacturers are prepared to fit the units they have chosen if the equipment is ordered with the car. In practically all cases it is charged as an extra on both British and American cars, though on the Jaguar it is standard equipment, not an extra. On American vehicles the equipment seems to be so much part of the car that it is evidently always required.

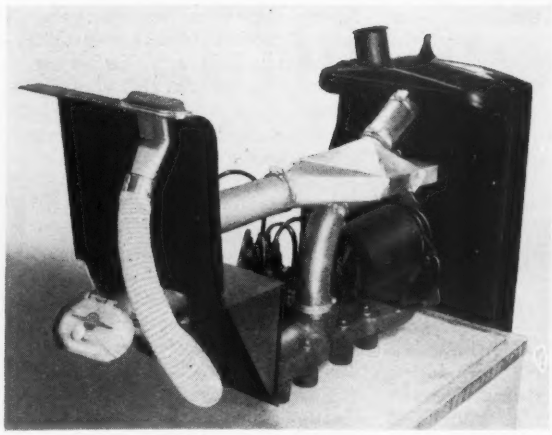
S. Smith and Sons have introduced a new model between the earlier two, and a simpler form of valve is now used for the distributor. The large size is generally used for export and has not been altered. They also have a small circular vertical pattern of the re-circulation type and another circular design for fitting below the seat of a car. This type is used on the Bentley.

Clayton C.B. type heater.

Clayton Dewandre make four principle types. The C.B. however is suitable for the majority of cars and requires pump circulation. The T.S.4 model is similar but the water inlet and outlet are at the top and bottom, so that it is suitable for thermo-syphon engines. Type S.C. is a special form of the C.B. model but has no provision for de-misting. It is fitted to the Land Rover amongst others. The type R.C.2 is a flat circular unit about 13in. diameter by 4in. deep and is used for cars with large many seated bodies such as some Humber and Daimler models. It is mounted under a front seat and discharges hot air horizontally in all directions, the intake being above. No provision is made for fresh air admission.

Delaney Gallay showed the A4 type circular heater unit designed for mounting inside the body below the facia board. They also showed the A5 combined heater and ozone air conditioner which is similar but slightly deeper. Both these units are designed for pump circulation and can either deliver fresh air or circulate the air in the body. In the A15 thermo-syphon unit the matrix is installed between the cylinder block outlet and the radiator header tank, where the water is at its maximum temperature. Air flow through the matrix is produced by the car radiator fan and is ducted to the driving compartment of the car for heating and de-misting. Complete sets of parts, including engine connections, are supplied for fitting to most existing cars, and where it is possible to build de-mister ducts and air deflectors into the dashboard, these are supplied as part of the equipment. The firm have produced a machine for cutting these ducts and will do the work if required.

The practice of mounting the heater unit and fan on the engine side of the bulkhead is gaining in popularity as it forms a compact installation and does not encroach on body space. The Rover "75", the new 14 h.p. Lanchester, the Austin "Hereford" and the Jaguar Mark VII, are examples of British cars equipped in this way, and the Kaiser de Luxe is of interest as it employs a similar scheme, though it is not usual American practice. In all these cases fresh air is admitted to the heater, though for rapid warming up it can be cut off and the air in the body circulated through the heater. In the Rover "75" installation shown, a standard Smith heater unit is used, fresh air being conveyed to it through a 3in. flexible pipe from the front of the car. The blower is installed at the air intake which is protected by a filter. The Austin A.70 "Hereford" saloon has the same arrangement and



Delaney Gallay heater installation for Ford cars.

Smith heating installation on the Rover "75".

employs the same make of units. The Jaguar Mark VII has a similar installation but in this case the blower is mounted with the heater unit.

The Clayton Dewandre system shown on the 14 h.p. Lanchester also has the heater unit mounted on the engine side of the bulkhead, but fresh air is drawn from the scuttle ventilator which is also used as a control. In these installations the normal method of distribution is used, heated air being delivered by the main control valve on the heat exchanger unit to the horizontal duct below the facia board, which supplies the body, and also to the de-misting ducts behind the screen. The quantity of air is also generally controlled by a rheostat in series with the motor, but control by water circulation is not used, though it can be cut out when desired in hot weather.

In the Kaiser de Luxe model the heater unit and fan are completely enclosed in a compact unit fixed to the front of the bulkhead on the right-hand side. A flexible pipe is used also in this installation and conveys fresh air from the front of the car along the right-hand side of the bonnet to the heater unit. In addition there is a similar pipe fitted along the other side of the bonnet and delivers cold air when required to the duct across the body behind the facia board. This cross duct is of large sectional area and capable of delivering a considerable volume of heated air to the body so that it is evidently not necessary to deliver air specially to the rear compartment. Five control knobs are fitted which operate when pulled out. They are labelled Defroster, Temperature, Blower motor and a further two which control air admission.

In the Bentley system a Smith flat circular heater unit containing a small fan is located under the passenger seat and delivers warm air to the centre of a short duct, near the floor and in line with the car, between the driver and passenger. The front end of the duct is level with the edge of the front seat and the back end level with the back of the seat. The ends of the duct are each divided to form two short outlets, inclined at about 90 deg. to each other, to distribute air over the whole floor of the body. A completely separate unit supplies warm air to the de-misting ducts behind the screen on either side. The radiator and fan of this unit are fitted low down behind the engine radiator and deliver air through a pipe to the screen, the fan being controlled by a switch and rheostat on the lower edge of the facia board. The outlets of the screen ducts are covered by narrow curved plates which can be partly rotated out of sight when not required. The de-misting unit will supply sufficient air for ventilation and the shape and size of the air channels has been designed to ensure silence in operation.

The Hudson "Commodore Eight" has a circular type heater mounted inside the body and attached to the bulkhead centrally and below the instrument panel. Fresh air is admitted through the scuttle ventilator as in the Lanchester, and the air in the body can be circulated through the heater when the ventilator is closed. The A.C. heater unit is fitted to the Vauxhall "Velox" as before, and the installation and method of control remains unchanged.

The Riley Company make most of their own units and the system is their own. A Smith centrifugal blower is rubber mounted to a detachable platform between the car radiator and the grille. The intake is screened by a

Clayton heater installation on the Lanchester "Fourteen".

gauze cover and the air is taken by a short flexible pipe to a solid metal tube fixed to the right-hand side member. From there it goes to the casing of the heater radiator mounted low down on the engine side of the bulkhead. The distributor chamber from this radiator is inside the front compartment, being secured to the underside of the battery box. Two controls are required, one dealing with admission of air to the car and situated on the passenger side and the other on the facia board in front of the driver, controlling by vanes in the heat distributor the actual distribution of the air admitted. This air can be directed either to the screen, the passenger or the driver, or divided between all or any in the required proportion.

BROACHING

Standard In-and-Out Fixtures and an Automatic Machining Cycle

BECAUSE of the very short cutting time in a broaching cycle, usually a matter of seconds, the loading and unloading times are of great importance. They must be short if full economic advantage is to be taken of the process. If the runs are sufficiently large, the obvious solution is to use special-purpose fixtures designed to give the shortest possible handling time for one specific part. Broaching is, however, such a speedy operation that unless very large quantities are required, expensive special-purpose equipment may lie idle for long periods. Furthermore, in the event of design changes, the fixture may have only a scrap value after only a short working life. For these reasons, there is much to be said in favour of standard fixtures which, although specifically designed to reduce handling time, can be adapted easily and cheaply to suit a wide variety of different components.

This use of standard in-and-out fixtures in an automatic machining cycle has been highly developed by The Lapointe Machine Tool Co. Ltd., Edgware, Middlesex, for work in conjunction with their broaching machines. A good example is a fixture arranged for incorporation in the automatic cycle of a Lapointe V3 vertical pull-down machine. This fixture is used on a set-up for simultaneously broaching the splines and sizing the bore of gear blanks made in tough EN24, 31, 34 and 36 steels. The dimensions are held to a tolerance of plus or minus 0.0005 in. and the broaching speed is 8-10 ft./min.

The fixture automatically draws clear from the tools for loading and unloading. This is effected by means of an internal electrically-controlled hydraulically-operated piston. To prevent accidents, the fixture is electrically and hydraulically interlocked with the cycle of the main slide in such a manner that operation is impossible unless the fixture is in its correct position. As a further safeguard, the operator must depress two buttons simultaneously in order to start the cycle. This ensures that the operator's hands are clear of the tools. The blanks sit on a level surface and are positioned by three projecting pins. As is common in vertical pull-down broaching, the work does not need clamping.

Two blanks are broached simultaneously. For loading, the fixture is withdrawn clear of the tools. After loading, two starting buttons are pressed to cause the fixture to move to the broaching position. This movement is controlled by two stop pins. When the broaching position is reached a cam on the fixture operates a limit switch to start the broaches on their downward movement at fast traverse.

As the ends of the broaches pass through the blanks they are locked in the pullers beneath the table. At the same time the broach-lifting mechanism is automatically opened to release the top end of the tools. At the same time, a cam on the side of the lifting mechanism relays electrical and hydraulic power to actuate the pulling mechanism and draw the broaches through the blanks. Also at this point in the cycle, the broach lifting mechanism ceases its downward movement and remains stationary until the broaches are returned for lifting clear from the work.

When the broaches are completely through the blanks, a limit switch on the main slide is operated. This stops the downward tool movement and also causes the fixture to retract for approximately 3 in. As the fixture reaches its extreme position, a cam contacts another limit switch to cause the broaches to be lifted while unloading and re-loading is in progress. On the return stroke the broaches move at semi-fast speed until the lifting mechanism engages with the ends of the broaches and the pullers release the other ends. When the tools are gripped, the lifting mechanism rises at fast traverse until the broaches are clear above the fixture.

The complete cycle takes approximately 15 seconds. During the operation the tool is sprayed with standard Lapointe soluble oil lubricant. As a guide to output, it may be stated that during one normal working week, 6000 gears, in 14 different batches involving 14 tool changes, were broached. A slightly different standard fixture, incorporating similar principles, is available for external operations on vertical surface broaching machines. (1923)

Crack Detection

AN improved crack detection process for non-ferrous metals has recently been developed by Fel-Electric, Ltd., 41, Sidney St., Sheffield, 1. It has been developed for use on non-magnetic materials and is based upon the conventional oil and chalk technique. It is known as the "Nonfertec" process and differs from the conventional technique in that the oil is used at room temperature and there is no necessity to wipe off any surplus oil. In addition, a special powder is used in place of chalk to indicate faults by means of brilliant red stains that are easily visible on any section. (1920)

Rust Remover

A RUST REMOVER produced by Cleros Industries, Durham Road, Boreham Wood, Herts., known as "Cleros", is manufactured for the treatment of steel and iron, and is also of use for providing aluminium articles with a keying surface for painting. It is stated that "Cleros" not only removes rust but has a neutralising action on the metal, with the effect of checking re-rusting. It is also claimed that the complete removal of rust is effected without harmful corrosive action. The substance percolates into the pores of the metal surface and acts as a binding medium for after treatment, whether this be painting or similar processing, or electro-plating. Two general methods of application are in use, namely, dipping and brushing. With both treatments, of course, the surfaces have to be thoroughly degreased.

Two-speed Axles

IN the review of commercial vehicle rear axles published in the *Automobile Engineer* for September-October, 1950, it was inadvertently stated that the Eaton two-speed hypoid geared axle is offered. In fact, the two-speed spiral bevel unit is offered as an alternative to the single speed hypoid bevel unit in the same axle. The Moss two-speed axle embodies hypoid gears and is designed for electric control.

THE PARIS SALON

More Stabilised Conditions and an Absence of Eccentric Designs

THE Paris Salon reflected the transition from a period of widespread re-design, to steady production of well established models. Although the French monthly production of commercial vehicles has remained substantially constant at about 9,000 vehicles per month, the production of private cars has steadily increased from about 16,000 per month in June 1949 to 25,000 per month in June 1950. In the first six months of 1950 the total production of vehicles was 168,523 compared with 141,665 for the corresponding period in 1949. Although the estimated total production of 300,000 vehicles in 1949 was not reached, the actual figure of 285,641 exceeded by 32,641 the total for 1929, which was the maximum figure previously attained. The 1949 production was as follows: private cars 187,653; buses and coaches 2,088; commercial vehicles 95,900. Private cars have been further subdivided into the following classification:—

Under 6 c.v...	..	80,110
From 6—8 c.v.	..	41,994
From 10—12 c.v.	..	42,316
Above 12 c.v.	..	23,233

These figures for private car production indicate the demand for economical transport in the form of really small cars, for it is fairly certain that the 4 c.v. Renault forms the bulk of the group below a rating of 6 c.v.

The success of this rear engined car can without overstatement be regarded as phenomenal. It is evident that whatever criticism may be directed at the inherent handling qualities of the vehicle, yet within its present performance capabilities it must be regarded as a thoroughly satisfactory design. Nevertheless, taking the long view, it is perhaps worth reiterating previous criticism of a design having a front/rear weight distribution of about 38/62 per cent. in conjunction with a true swing axle rear suspension. The front suspension layout embodying 10 deg. castor angle, return springs on the steering rack, and an anti-roll bar (despite the already high roll stiffness arising from the rear swing axle layout) appears to indicate that a strong oversteer tendency has to be counteracted. Tyre pressure also seems to be somewhat critical, so that there would appear to be little margin in hand for any possible increase in performance of the car as regards maximum speed. The point is rather more than academic, since vehicles of comparable dimensions are known to be capable of substantially higher speeds. There is thus an indication of the performance that the average vehicles in this class might be expected to reach in the normal course of development.

In general then, it is not surprising that Renault, Peugeot and Citroen have made scarcely any change in their models. Much speculation still centres on the 2 c.v. Citroen, examples of which are now to be seen on the road, while a van body has been produced that is considerably more attractive to the eye than the somewhat crude-looking saloon. For the van the engine swept volume has been increased to 425 c.c.

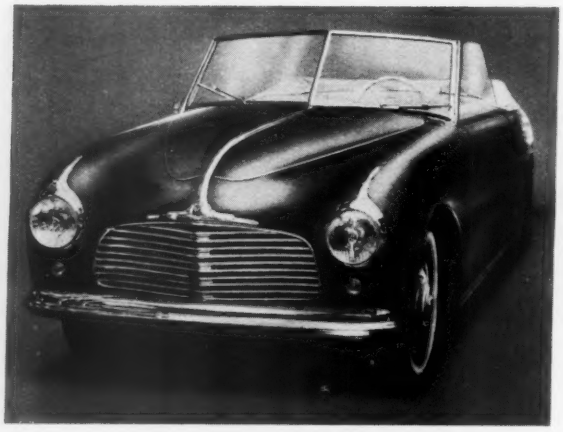
Technical interest at the Salon centres on Italian and American vehicles, namely the Fiat 1400, Lancia "Aurelia", Alfa Romeo 1900, Studebaker and Kaiser.

So far as bodywork is concerned, coachbuilders are evidently passing through a period of relative stagnation. Indeed it may well be that the problem of developing an artistically as well as practically satisfying body for a medium sized car in the current fashion defies solution. The whole question of passenger accommodation in the family saloon type of car of about two litres swept volume might profitably be re-examined. Is there, for example, any real virtue in the kind of car that provides too much room for four persons but too little for six? It may also be, that three abreast seating really demands greater width than can be justified in European conditions. Many owners have already become aware of the vulnerability to minor damage of full width bodies. From the point of view of appearance, this fashion has so far resulted only in bulky and mis-proportioned bodies on chassis having exiguous wheelbases. There may therefore be a good case for the return to the frankly four-seater body of more normal proportions that would allow a more balanced appearance to be obtained, while providing generally acceptable accommodation.

Regarding specialist coachwork, it is still true that for elegance and tasteful modelling the Italian cars retain the pre-eminent position. In the luxury class, it is evident that the French industry is handicapped by the absence of suitably large chassis, on which the highest abilities of the French coachbuilders can be employed to full advantage. They are, in fact, restricted to chassis of markedly sporting characteristics, and while there are excellent examples of sports saloon and drophead coupé bodies, attempts to carry a sedanca de ville, for example,

Labourdette convertible based on 4 c.v. Renault components.

The Fiat 1400 convertible.



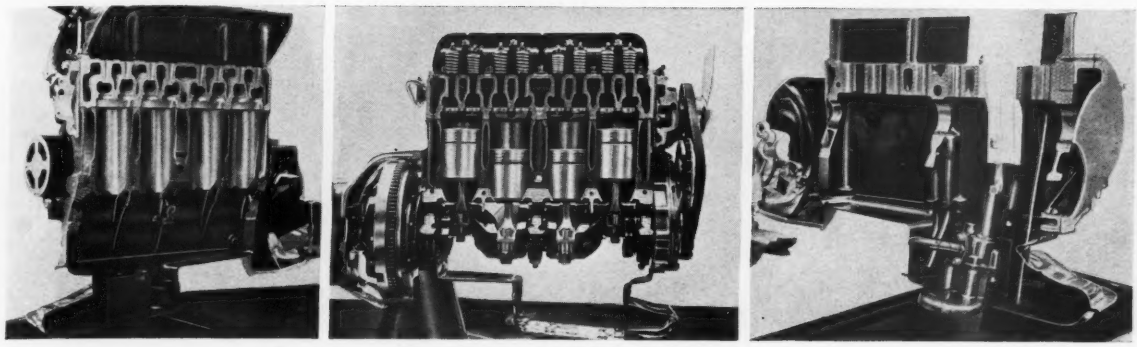
Figoni and Falaschi coachwork on a Simca 8.

Plain treatment of the Siata 1400

Grille of Farina-bodied Alfa-Romeo.

The new Borgward convertible.

The Alfa-Romeo 1900 saloon



Sectioned model of the Fiat 1400 engine.

on the same chassis met with indifferent success. Much good work is being done, however, on smaller chassis in the medium priced class, a popular basis being the 1200 c.c. Simca. One coachbuilder, indeed, restricted his display to three vehicles on this chassis.

As usual there were wide variations in front end treatment, which in general is becoming less ornate. There were still examples obviously designed to catch the eye, as the Labourdette convertible based on 4 c.v. Renault components and the Guillore body on a Simca. An encouraging detail feature is the return to legible instruments with circular scales, in many cases well placed for the driver's vision. As might perhaps be expected from a car that is primarily functional, the layout on the Ferrari was perhaps the most commendable, although the Simca arrangement is also easily read.

Among the Continental cars appearing at the Salon for the first time, undoubtedly the Lancia and the Fiat 1400 held the greatest technical interest. The Lancia is a relatively expensive car exhibiting much novelty and great care in detail design, while the Fiat is an advanced example of design intended for large scale and economical production. Apart from the fact that the Lancia follows convention in that the engine is at the front and drives the rear wheels, the whole design is unorthodox. It has a six-cylinder 60° V engine, 70 mm. by 76 mm. bore and stroke with inclined overhead valves operated from a single camshaft and carried in hemispherical combustion chambers. The drive from the engine is taken by a divided propeller shaft through a single plate clutch mounted in unit with the four-speed gearbox and spiral bevel final drive assembly. The independent rear suspension is a hybrid type between the trailing link and swing axle layouts in which the trailing link characteristics may be said to predominate, since the axis of swing is inclined at 60° to the longitudinal axis of the car. Thus the roll centre is lowered compared with a true swing axle design and the wheels "toe in" as the suspension deflects either side of the main position, thereby introducing understeer geometry.

A feature of the rear suspension, in which coil springs are embodied, is the very large amount of rubber, not only at points such as the wishbone pivots but also in the spring abutments and mounting points for the gearbox and final drive assembly. This design policy is doubtless the outcome of the need to isolate gear noise and road rumble from the body structure. It is however interesting to note that the independent front suspension, which is of the traditional Lancia sliding pillar type, embodies no rubber insulating pads. Thick rubber bushes are used, however, for the track rod joints. A full description of this interesting chassis is in preparation and will be published shortly in the *Automobile Engineer*.

It is evident that use of the V engine is not dictated by considerations of space, since it is mounted well back in the integral body/frame structure. Also, even if the toe board were carried forward as far as front wheel movement would permit, there would still be ample room for an in-line engine. The transfer of the clutch and gearbox to the rear of the car, however, does remove a major obstruction from the front floor, but possibly the real reason is to be found in a desire to increase the moment of inertia of the car about the vertical axis in the interests of good handling characteristics.

It may be recalled that in connection with the pre-war German racing cars there was a sharp division of opinion on this point, the original Auto-Union being designed to have a low moment of inertia in the horizontal plane in order to ensure quick response to changes of direction. The Mercedes-Benz policy however, aimed at the reverse effect, namely to increase the moment of inertia in the horizontal plane in order to prevent undue sensitivity to changes in direction. It was generally agreed that the Mercedes-Benz was the better handling machine. It would appear, however, that the case is by no means proved and further fundamental information on the handling characteristics of cars must be available before this conclusion can be fully agreed.

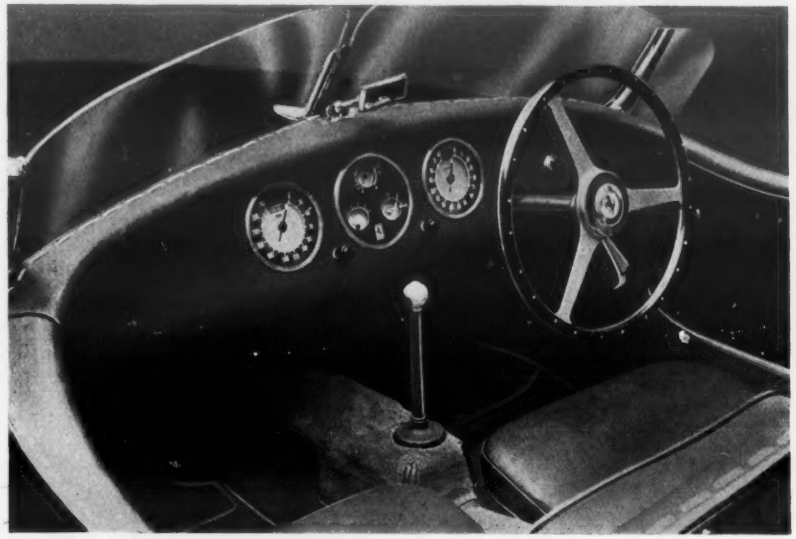
Reverting to the Lancia, it will be apparent that the drive is indirect on all gears and baulk synchromesh mechanism is provided for top, third and second. An incidental advantage of this arrangement that will probably be appreciated by the driver is that the synchronising cones are all mounted on the driving shaft and therefore operate in each speed with the same mechanical advantage, thus overcoming the occasional difficulty of engaging second speed with the conventional gearbox arrangement.

Perhaps the most important new car, in the widest sense of the term, is the Fiat 1400 announced earlier this year. In seating capacity and general passenger amenities it is comparable with many British post-war cars in that it can be regarded as a 5/6 seater saloon of fairly high performance for its type. It employs a smaller engine, however, than most of its competitors, namely one of 1395 c.c. swept volume, and it is also appreciably lighter. The engine evidences the prevailing tendency towards large bores carried almost to extremes, the bore and stroke being 82 mm. by 66 mm. respectively. This is undoubtedly the result of the higher road speeds possible for a given power output with the modern style of body, since the long stroke engine would be called upon to operate continuously at excessively high piston speeds under many conditions of Continental driving. The compression ratio is 6.7 to 1 and the power output 45 b.h.p. at 4,400 r.p.m., both conservative figures and doubtless allowing plenty in hand for future developments.

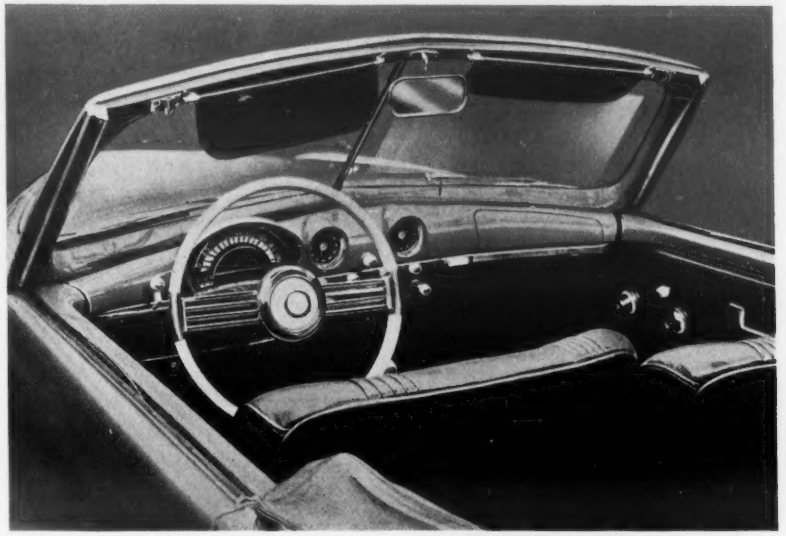
The engine as a whole is an excellent example of modern design technique

Unusual front end treatment by Guilloré on a Simca.

Four-door four-light saloon body on the new Alfa-Romeo 1900.



Clearly read instrument panel of the Ferrari.



Instrument layout of the Simca 8 Sport.

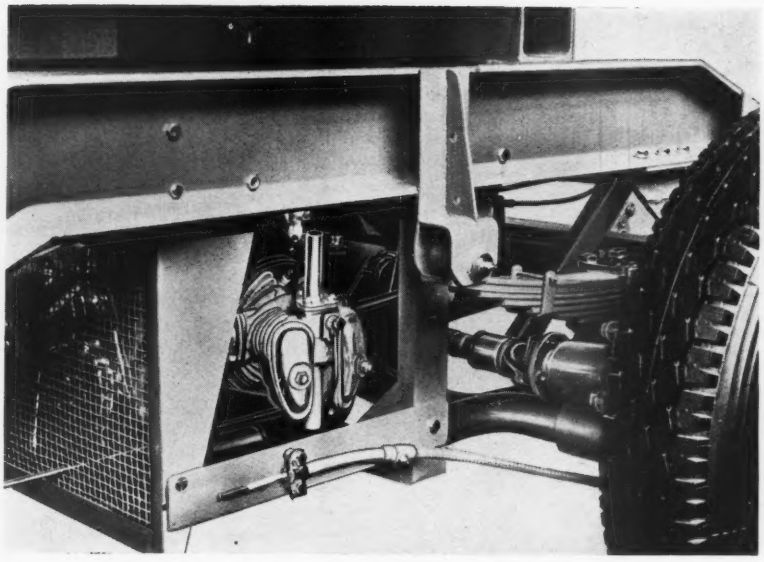
and embodies wet cylinder liners. The cylinder head is of aluminium alloy with inserts for both inlet and exhaust valves. The valves are arranged vertically in the cylinder head and are operated by push rods and rockers from a camshaft low down in the cylinder block driven by a triple roller chain from the front end of the crankshaft. While this valve arrangement has much to commend it from the manufacturing aspect, it is difficult to provide adequate cooling at the point where the valve seats are adjacent. While conditions are doubtless improved by the use of aluminium alloy for the main head casting, the break in the heat flow path resulting from the use of valve seat inserts may tend to off-set the advantage. The single plate clutch and gearbox are in unit with the engine and four forward speeds are provided, with synchromesh on top, third and second.

A feature of the gearbox is that the second speed wheels are behind the rear wall of the main gearbox casing, while the third speed gears are just in front of the wall. The first speed mainshaft gear slides on the top and third speed dog sleeve so that the least well-supported gears are those which are least frequently employed.

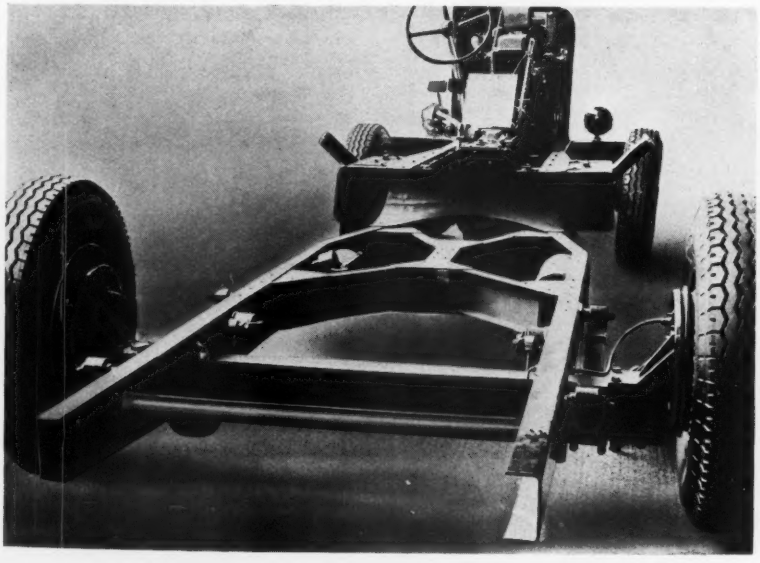
A divided propeller shaft is used with an unusual arrangement in the first stage. There is a rubber block type of coupling at the gearbox from which a drive is taken through a small diameter shaft to the front universal joint of the second stage shaft which is of conventional design. The light shaft is enclosed in a tube within which are two intermediate supports for the shaft.

Mounted on the front end of the final drive pinion shank is the drum for the hand brake. While a transmission hand brake simplifies the linkage problem and may perhaps result in less effort being required on the lever, the arrangement leaves something to be desired when it is necessary to jack one side of the car. The rear axle is of the hypoid type and of conventional design, but the brake drums are of aluminium alloy with liners and are provided with ventilating slots designed to promote a flow of air through the drums.

An unusual form of rear suspension is employed in which the load is taken by coil springs whereas the axle is located by the equivalent of two quarter elliptic springs extending rearwards from the body structure to the axle, while behind the axle is a spring steel bar, the ends of which are carried in rubber bushes on the frame. The centre, which is bowed towards the axle, is attached to the differential housing through a third rubber bush. This bar provides lateral location for the axle and at the same time provides a stiffening of the spring rate by bending, since the axle and bar move in contrary arcs. Direct acting dampers are fitted in the transversely inclined or "sea-legs" position, thus affording an additional, transitional lateral stiffness. The front suspension is by means of wishbones and coil springs with direct acting dampers mounted inside the springs. There is also an anti-roll bar.



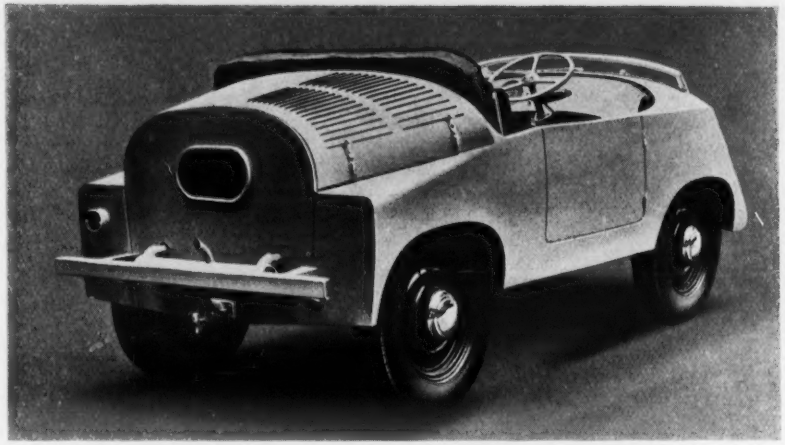
Power unit installation of the F.A.R. "Poney Mecanique".



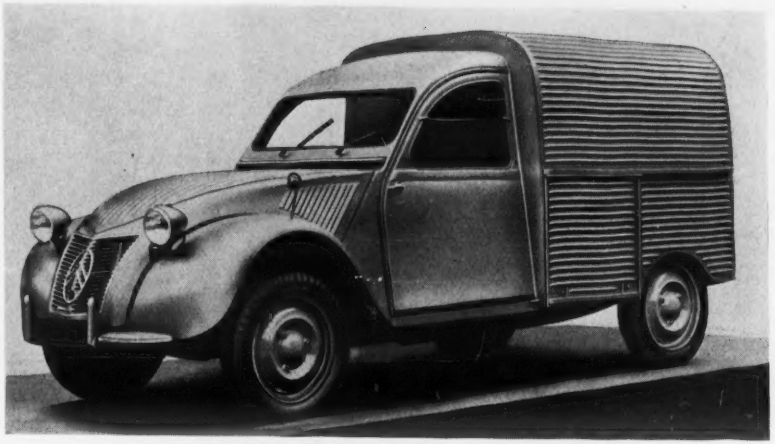
Labourier front wheel drive low loading truck chassis.

Falling in between the integral type of construction and the separate frame type, the body/frame structure, as in the case of the Lancia "Aurelia", can be employed in conjunction with specialised coachwork that does not rely upon the roof for additional stiffness. In these cases the frame is stiffened by converting it into a platform type of structure.

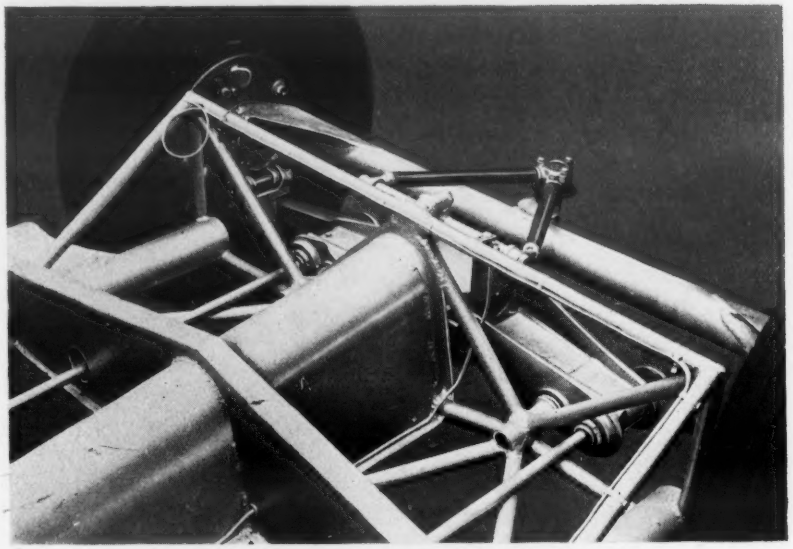
Much interest attaches to the introduction of a 1.9 litre Alfa-Romeo, having a four-cylinder engine. Although little technical information is as yet available, it is interesting to note that the swing axle suspension used on the larger models of this make has been abandoned. This model now has a conventional rear axle, located fore and aft by means of light radius rods and transversely by means of a Panhard rod. The rear suspension is by means of coil springs. This type of spring is also used in the front suspension, which is of conventional



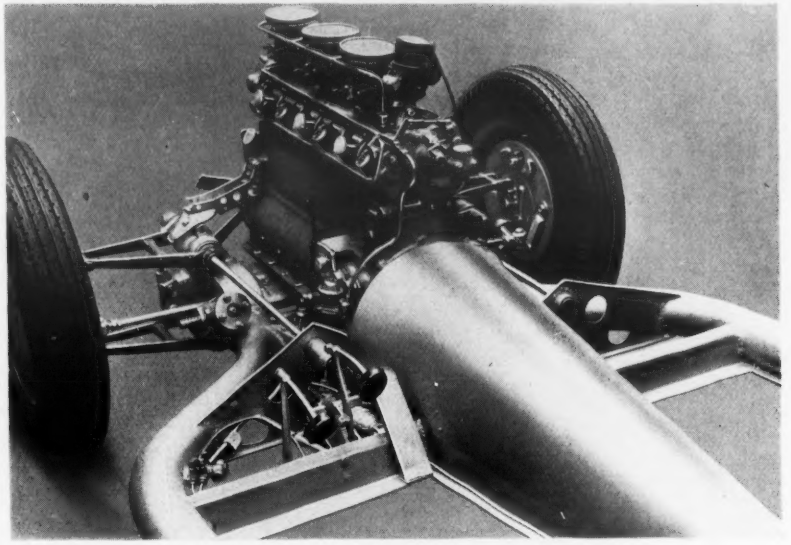
Prototype Irat utility vehicle with air-cocled flat twin engine.



Citroen light van with 425 c.c. engine.



Rear of frame structure of the Veritas.



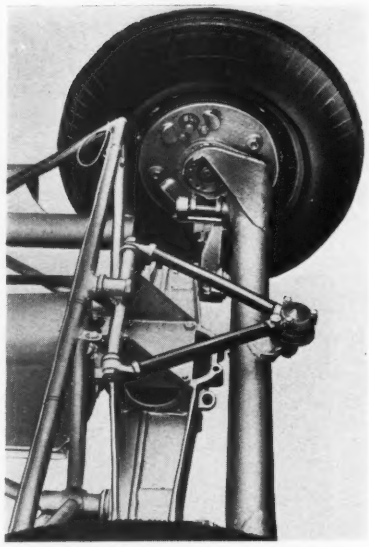
Front end of the Veritas showing torsion bar suspension

wishbone type, and it is noteworthy that no rubber is used in any of the wishbone bearings.

The engine has a bore and stroke of 82.5 mm. by 88 mm. developing 80 h.p. at 4,800 r.p.m., and has twin overhead camshafts. In unit with the engine is a single plate clutch and four-speed gearbox, the final drive being by means of hypoid bevels. There are many British-made components in the car, including Girling hydraulic brakes.

While following the prevailing fashion for full width bodies with an unrelieved expanse along the sides, the car is perhaps rather less clumsy in appearance than many and the frontal treatment is comparatively restrained. The standard body is a four-light saloon.

Shown in chassis form for the first time, the Veritas has an unusual frame built up very largely from tube. Torsion bars are used front and rear, the front suspension being by means of approximately equal length wishbones with the torsion bars connected to the upper links. At the rear, the De Dion axle is located by means of the "A" bracket familiar on B.M.W. and Bristol designs, while skewing of the axle beam is restrained by the connecting links from the hubs to the torsion bars. This construction can be seen in the accompanying illustration, which shows the assembly without the final drive and cardan shafts. This car is, of course, intended for competition use, and the design is therefore expensive. Nevertheless the suspension appears to have much to commend it for application to the touring car.



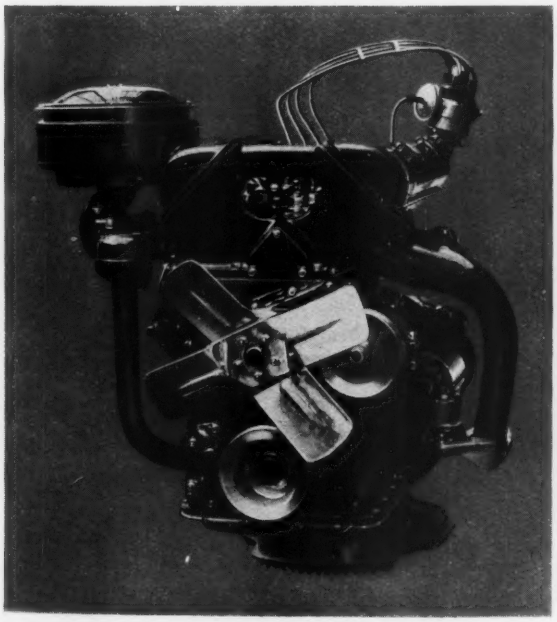
De Dion rear suspension on the Veritas.

Introduced at the Paris Show was the 1951 Studebaker Land Cruiser, having the new V-eight engine. This engine has a bore and stroke of 3⅜in. by 3¼in. and is an overhead valve 90 deg. V developing 120 b.h.p. at 4,000 r.p.m. with a compression ratio of 7 to 1. The swept volume is 233 cu. in. as compared with the previous 245 cu. in. engine developing 102 b.h.p. As in the case of similar new American engines, the basic design is stated to be capable of development towards the use of much higher compression ratios, in this case a figure of 14 to 1 being visualised.

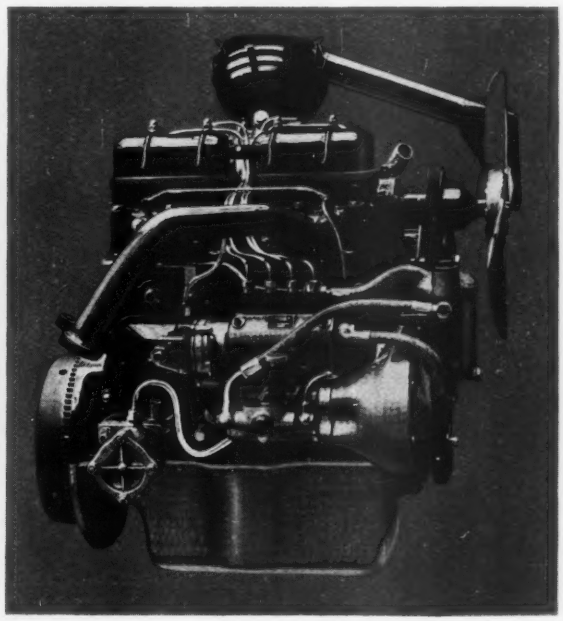
The one-piece cylinder block carries a five bearing crankshaft in steel-backed white metal lined bearings 2½in. diameter. The connecting rods, which also have steel backed white metal big-end bearings, are mounted side by side on the crankpins and the gudgeon pin is clamped in the small end. Along the centre of the V lies the camshaft, also carried in five bearings and driven by a Celeron gear meshing with a cast iron gear keyed to the front end of the crankshaft. The valves are operated from barrel-type tappets through push rods and rockers, with self-locking screws at the push rod end of the rocker for clearance adjustment. Single valve springs are fitted.

The cylinder heads are interchangeable right and left and the water jacketing appears to give good cooling around the valve seats and sparking plug bosses. A single casting forms the induction manifold on which is mounted a dual downdraught Stromberg carburettor in association with a hot air automatic choke.

Among other interesting chassis details are the four-[illegible]mi-elliptic laminated springs with interleaves. The springs are 2½in. wide and the interleaves are of extruded polythene of I—I section. It is claimed for this material that the inter-leaf friction remains substantially constant throughout the life of the spring, and that no lubrication is necessary. The flanges of the interleave section seal the blades against mud and grit and also it is claimed, eliminate the need for sideways location of the blades by means



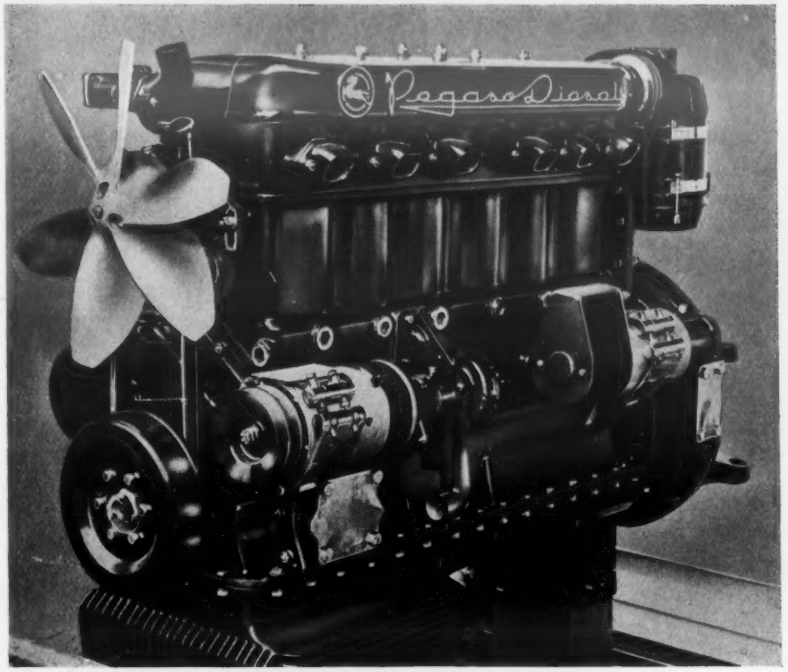
Alfa-Romeo 1900 four-cylinder engine.



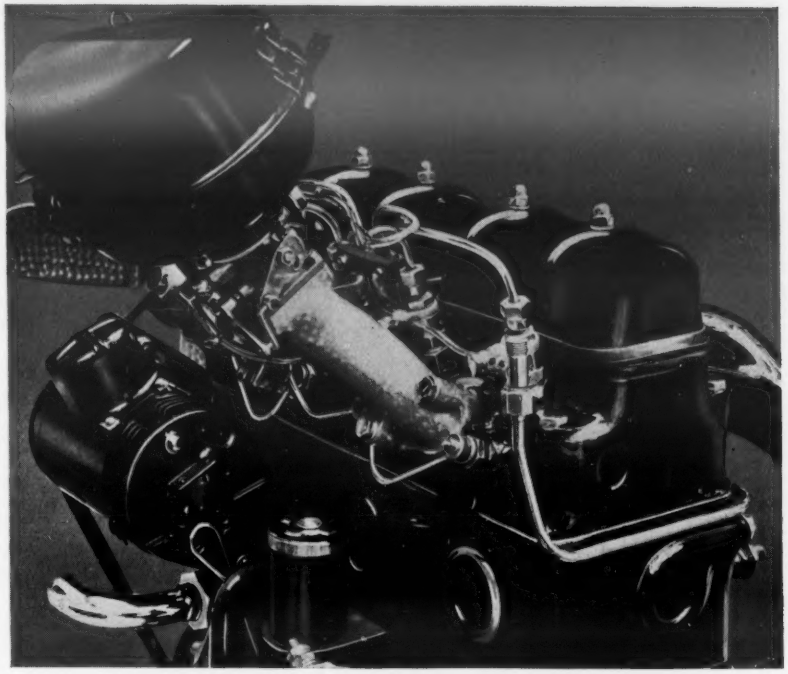
Mercedes-Benz 1.7 litre diesel engine.

Farina saloon on an Alfa-Romeo chassis.

Saoutchik sports saloon on a Delahaye chassis.



The Pegaso 9.3 litre diesel engine.



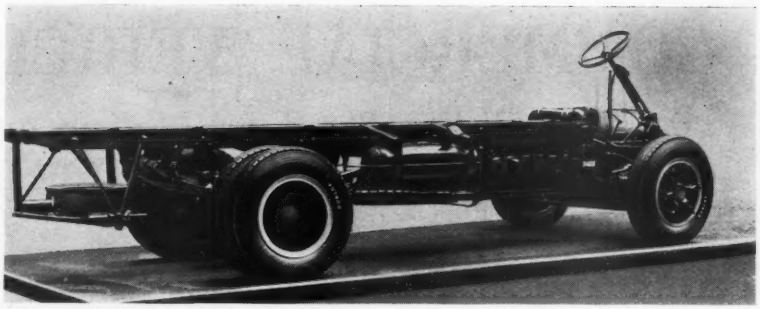
Air manifold and injectors of the 1.7 litre Mercedes-Benz diesel.

of clips. Whether clips have been eliminated on the Studebaker is not known, but the claim should perhaps be accepted with reserve. It would also be interesting to know whether the material, though apparently very tough, has a satisfactory life in association with the customary spring blade which is rolled slightly hollow.

Direct acting dampers mounted "sea legs" fashion are now fitted and the transverse stabilizer has been abandoned. It is claimed that the wide spring increases lateral stability, although whether lateral stiffness of the spring itself is of great importance in relation to the stiffness, or lack of stiffness, of rubber eye and shackle bushes seems debatable.

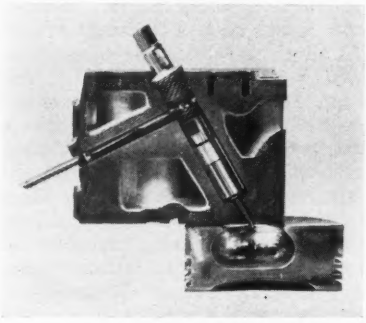
Both the Studebaker and the Kaiser "Henry J" embody a further simplification of the front suspension. On both cars the wishbones are arranged with a considerable rearward dihedral, and the ends of the anti-roll bar are simply clamped along the front face of the lower wishbones. There are no bearings on the frame, so that the bar functions principally in bending, and further, adds to the normal suspension rate.

While the "Henry J" is admittedly a low priced car, it appeared that the general standard of finish fell below either British or Continental standards in the lowest price groups. This model, with others in the Kaiser range, has a substantially slab-sided type of body, but with a slight depression forward of the rear wheels to break up the surface and to give the effect of a rear wing. The emphasis, however, is not great and the impression given by a superficial glance is that the body has suffered a trifling mishap.



Renault 5-ton chassis with under-floor diesel engine.

Interest in commercial vehicles centred on the Renault underfloor engined goods chassis and the Pegaso, a Spanish design shown for the first time. Two versions of the Renault are available, of 5 and 7 tons capacity, both embodying a 6.2 litre oil engine



Pegaso combustion chamber and injector mounting.

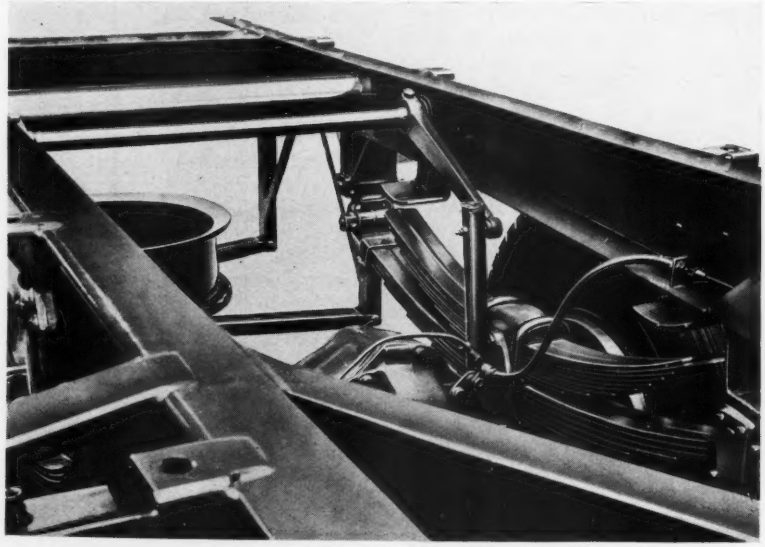
of 105 mm. bore by 120 mm. stroke developing 105 b.h.p. at 2,500 r.p.m. The engine lies on its side amidships, below the frame side members which provide a flat floor from the rear to a point just forward of the engine where the radiator is mounted. At this point the side members drop to provide a low mounting platform for the cab.

The transmission comprises a single dry plate clutch and five speed gearbox with direct drive on fourth. For the 5 ton chassis a spiral bevel single reduction rear axle is provided, whereas the 7 ton chassis has a double reduction axle. Suspension is by semi-elliptic springs, with a well designed anti-roll bar at the rear. The bar has splined ends to which the arms are attached, links connecting the ends of the arms to the axle casing.

Typical of the Continental heavy chassis as regards quality of finish and apparent complication, the Pegaso goods chassis shown had a six cylinder direct injection oil engine of 115 mm. by 150 mm. bore and stroke, giving a swept volume of 9347 c.c. and developing 125 b.h.p. at 1,850 r.p.m. The cylinder block is of light alloy and has nitrided wet liners, while the two cylinder heads, each covering three bores, are also of light alloy. Four compression and two scraper rings are carried by the piston, in the head of which is formed a combustion cavity. The chrome-molybdenum crankshaft is carried in seven main bearings. Self-adjusting tappets are embodied in the valve gear, an unusual feature for this type of engine.

A torsional vibration damper is fitted, and the water pump is driven in tandem with the dynamo by double vee-belts. On the opposite side of the engine are the air compressor and fuel injection pump, also arranged in tandem. Behind the cylinder block is a duplex air filter of the oil wetted type.

In unit with the engine is a single dry plate clutch. The separately mounted gearbox gives eight forward speeds, and the casing is split on the vertical centre line. The nose piece of the rear axle is similarly split, and houses spur reduction gears. The final drive is by spiral bevel gears, and suspension front and rear is by semi-elliptic springs with direct acting dampers. Auxiliary springs are fitted at the rear.



Rear suspension of the 5-ton Renault chassis showing anti-roll bar.

COMMERCIAL VEHICLE BRAKES

A New Girling Range for Medium and Heavy Vehicles

THE engine power, weight and speed of commercial vehicles are steadily increasing and the duty expected of the brakes is much more severe than used to be the case. Considerations of drum stiffness make deep ribs desirable, while high drum temperatures necessitate increased ventilation clearance inside the wheels. On this account, smaller drums are now becoming general, in conjunction with moulded linings. This combination gives reduced wear and temperature "fade," with lower coefficients of friction than the original woven material.

All these factors combine to demand higher shoe pressures and to place a premium on efficiency in the operating mechanism. Even where ample power servo assistance is available it cannot be applied to the handbrake, the efficiency of which, far from satisfactory at present, will be still further reduced.

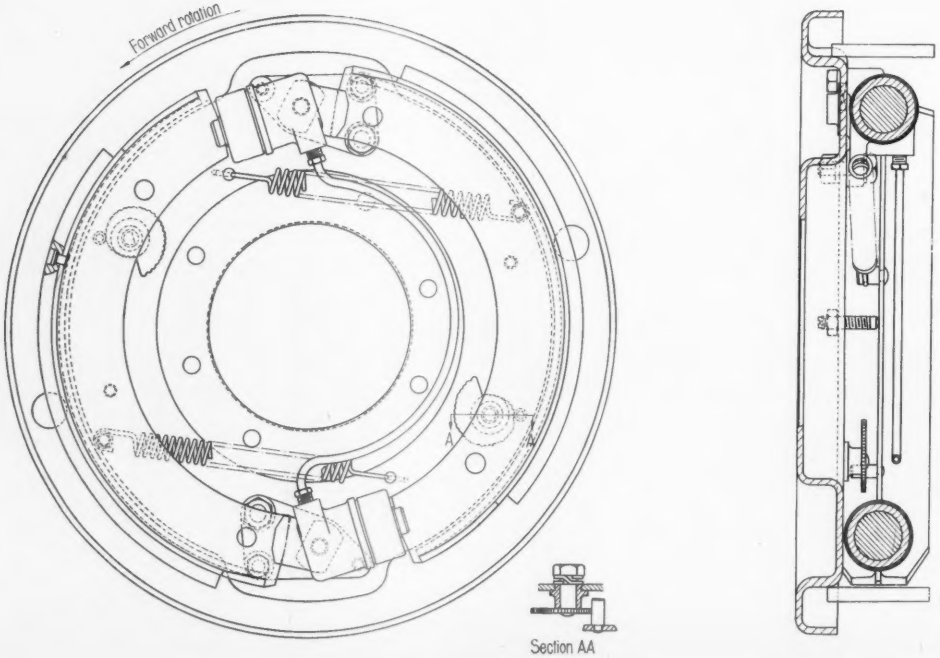
The new Girling commercial vehicle brakes deal with the problem in a very adequate fashion, since they provide two-leading-shoe operation for both front and rear. The handbrake embodies this provision for both forward and rearward motion, so that making a restart on a steep hill should be a matter of relative ease.

The new range of brakes is designed for two classes of vehicles, namely those of medium capacity with front shoe widths of 2½in or 3in and rear shoes 3½in, 4¼in or 5in wide, and heavy goods and public service vehicles, in which the front shoes can be 3½in or 4¼in wide and the rear shoes 6in for normal chassis or 7in for vehicles of 8ft 0in overall width. Brakes in the first category have linings ⅜in thick while for the heavy goods and public service vehicle, the linings have a thickness of ½in. In all cases two-leading-shoe operation is provided at both front and rear. If desired, the rear brakes can be supplied to give two-leading-shoe action in both directions, a feature of considerable value in the case of a bus having to make frequent starts on the hand brake on rising gradients.

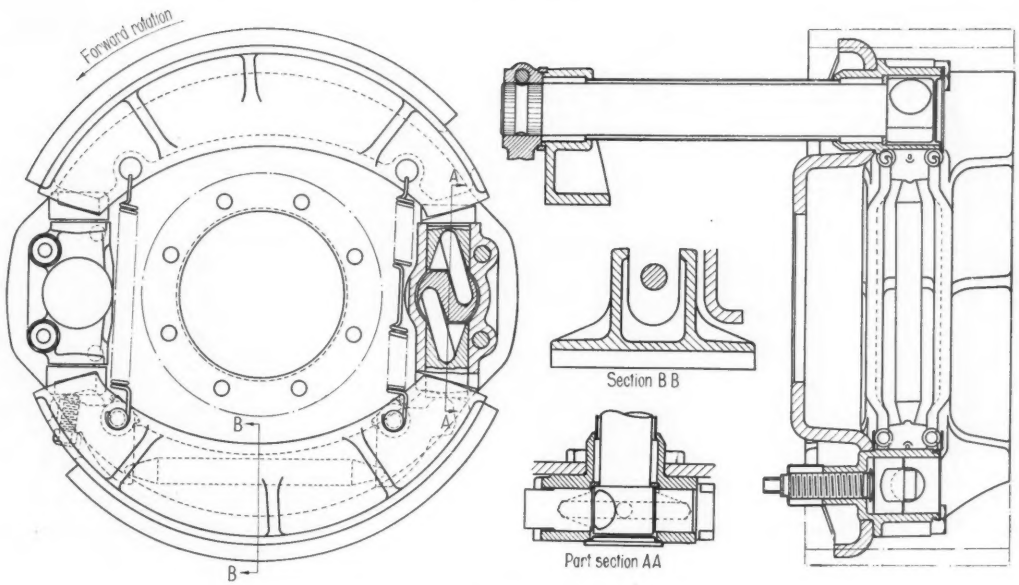
Regarding the front brakes in the medium capacity range, these are of normal design and have internal wheel cylinders. The drum diameter is 16in in this case only and the shoes are of T-section. In common with all the new Girling brakes and following a practice which the firm were the first to introduce to this country, the shoes are of the floating type. The shoe lining covers 110 deg or to 1⅝in of the heel of the shoe, which bears on an abutment set at a negative angle of about 4 deg with the radial line. In conjunction with linings having a coefficient of 0·35 this gives an approximately symmetrical wear pattern, greatest at the centre and least at the two ends.

One take-off spring only is fitted to each shoe and is at the heel end, its other end being anchored to the backplate. The object is to give a moderate take-off moment combined with a heavy seating pressure on the abutment to check excessive movement under road shocks.

The springs are inclined inwards and pull the shoes against adjustable squaring stops screwed into the backplate. Clearance adjustment is by snail cams, the serrations on which have rounded crests to obviate excessive wear. The wheel cylinders are diameter 1⅜in, and their pistons are protected by sliding pressings swaged onto their tips. Each cylinder is secured to the 6 s.w.g. backplate by two bolts and one stud.



Medium capacity front brake assembly.



Heavy duty rear brake with cam operation.

As previously mentioned the $\frac{3}{8}$in thick linings are offered either $2\frac{1}{2}$in or 3in wide. They can be supplied riveted to the shoes or alternatively can be bonded at the makers' works. While a choice of lining material is offered, the makers favour moulded linings as giving reduced wear and less tendency to " fade " by drop in coefficient of friction with heat.

Elaborate plant has been installed to handle the bonding process, which gives a very secure adhesion. Every shoe is tested after leaving the bonding oven by applying a considerable shearing load to the edge of the lining. This procedure implies the use of a hard and dense lining, since material at all soft would deform and become damaged at the edge by the severe test pressure applied.

Rear brakes

In the medium-capacity range the rear brakes have roller-wedge expanders, operated either by the usual rodwork or by external wheel cylinders. The wedge angle is 13 deg and shoe movement at centre for full travel is 0·098in with a stroke of $\frac{7}{8}$in. Since the expander housing acts as the anchor for one of the shoes it must be securely attached to the backplate. To obviate any binding of the wedge assembly which might set up unequal pressure on the shoe-tips, the actual wedge consists of a cylindrical piece with bevelled ends, free to slide laterally to a limited extent in the body of the wedge unit.

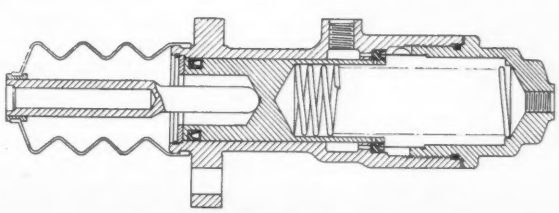
The adjuster comprises two bevel-ended plungers spread by a double wedge, actually cylindrical in outside form, with two wedge recesses milled in it, in which the flatted and bevelled ends of the plungers fit. The wedge does not therefore revolve, but slides laterally under control of the adjusting screw, the tip of which rotates in a recess in the wedge, to which it is attached by a peg fitting in a groove. Locking is by a bowed plate spring, made to turn with the adjusting screw by two flats and having dimples on its ends working in holes drilled in the face of the wedge member. A swaged-on pressed steel cover protects the exposed thread of the adjusting screw.

The shoes are fabricated and have two webs, with a space of $1\frac{1}{8}$in between them. The radiused tips of the webs bear on surfaces milled on the heads of the adjusting plungers at an angle of 15 deg with the centre line of the brake assembly making a positive angle of about 9 deg with a radial line through the point of contact. The lining is carried right to the heel of the shoe and embraces 112 deg, these proportions giving symmetrical wear when lining of 0·35 coefficient is fitted.

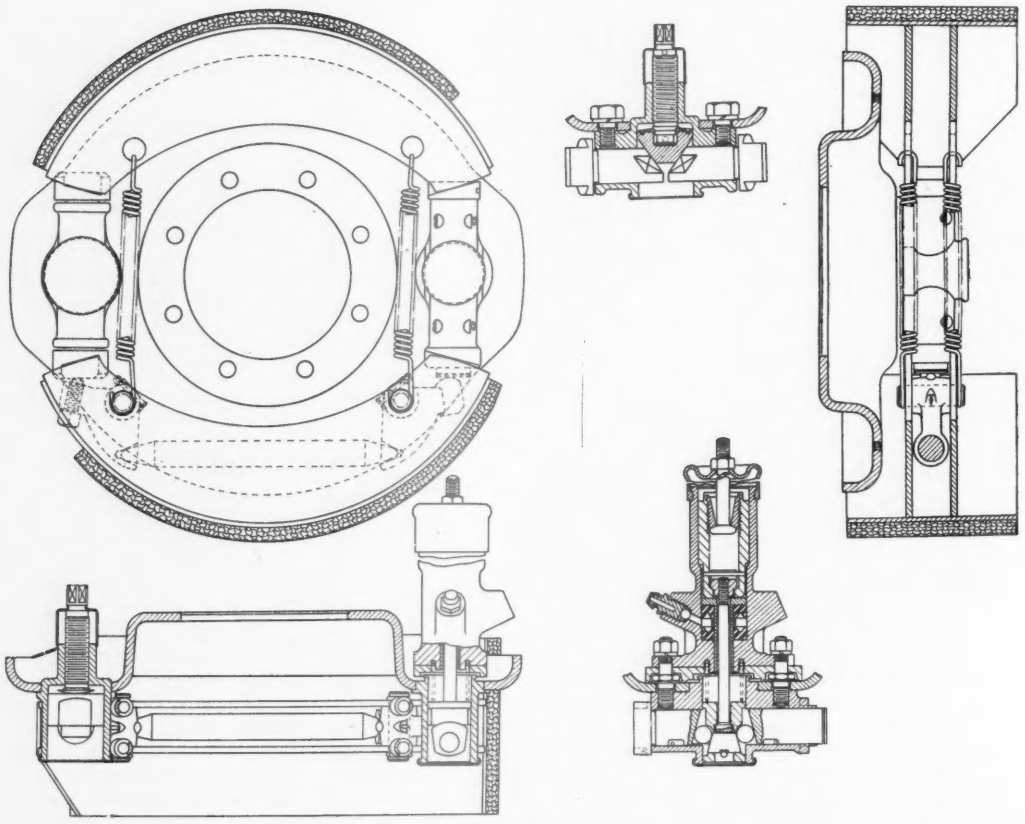
When 2 L.S. operation in the forward direction only is required, the lower shoe is fitted the opposite way round and its heel bears on wedge faces milled on the aluminium - bronze body of the expander housing. Between the webs of the lower shoe are fitted two bell-cranks connected by a ball-ended strut, their outer ends bearing on the lower adjuster plunger and expander plunger respectively. They turn on pins passing through the webs and prevented from working out by split-pins in the bell-crank bosses fitting into grooves turned in the pins, the outer ends of which are also grooved to take the twin take-off springs. Initial adjustment to allow for accumulated errors is provided by a hardened setscrew with a rounded tip bearing on the case-hardened face of the adjuster plunger.

Reverse effect

The webs of the upper shoe bear direct on bevelled faces milled on the upper expander plunger, this shoe acting in the normal way as a trailing shoe on reverse rotation. By duplicating the bell-crank mechanism and modifying the expander housing and plunger to correspond, the brake can be arranged to give 2 L.S. effect in both directions. This provision is obviously advantageous on a bus working on a hilly route, enabling the driver to restart on the handbrake on a gradient without employing so



2in diameter master cylinder assembly.



Heavy duty rear brake with transverse wheel cylinder.

much effort as to lose all sense of "feel" when engaging the clutch and releasing the brake at the same instant.

It should be noted that in the case of this brake and the heavy and public service vehicle brake, the backplate does not enclose the brake drum, it being made of stout material but only large enough to act as a torque plate to take the expander and adjuster housings. Some users, especially bus operators on a hilly route, prefer to leave the brakes open to get better cooling. For those who want enclosure, light cover plates can be supplied. With $\frac{3}{8}$in lining the brake is intended to work with a drum $15\frac{1}{4}$in diameter; the heavy vehicle brake, which embodies many of the same components, has a $15\frac{1}{2}$in drum with $\frac{1}{2}$in lining.

Drum diameter

The makers are to be congratulated on their courage in specifying a drum smaller than usual in order to allow greater drum stiffness and more cooling clearance between wheel and drum. The slight sacrifice of lining area and brake power should be more than compensated in service by the greater rigidity of the system, making for reduced lining wear on account of reduced drum distortion under load.

The heavy vehicle brake is identical in many of its parts, namely bell-crank and adjuster details. The shoes, however, are either 6in or 7in wide and are Meehanite castings. The torque plate is stouter and the adjuster and expander are secured to it by two bolts and two setscrews.

Cam operation

The front brakes have an external cylinder while the rear brakes can be supplied with operation by the orthodox brake camshaft. This is enclosed in a housing and expands the plungers by ball-ended push-rods seating in burnished spherical recesses in the head of the "camshaft," which actually becomes a double-armed crank with an effective radius of $\frac{1}{2}$in. The housing is charged with Keenol grease and the shaft runs on Torrington needle-roller bearings.

An angular movement of 37 deg maximum gives a lift of 0·170in to the centre of each shoe. With a co-efficient of friction of 0·35 the shoe factor, i.e. the ratio of drum drag to total shoe tip pressure is 1·55. The front brakes can be provided with the same "camshaft" operation as the rear, with an external hydraulic or air cylinder coupled to the usual camshaft lever. The heavy vehicle brake assembly has a hub clearance of about 7in but, if required, leaf-springs can be fitted for take-off, giving a clearance of 8in.

Master cylinder

For heavy vehicles the standard master cylinder has a diameter of 2in. Following the firm's standard practice, a plunger working in a housing is employed instead of a piston working in the bore of a cylinder. The plunger is chromium-plated and burnished to an exceptionally high degree of finish, and the working pressure seal is a U-shaped ring fitting in a recess in the housing and retained by a thin distance piece. Recuperation oil is fed to the back of the seal, the heel of which has an annular enlargement communicating with a number of holes in the plunger. When the plunger moves inwards there is a balance of pressure on both sides of the lip of the seal. Quite apart from the fact that the hole passes the seal "heel first," there is therefore no tendency to tear the rubber when "pumping" the brake.

CONTINUOUS STRIP MILL

An Important Development by Northern Aluminium Company Limited

ONE of the most important developments of the post-war period is the continuous strip mill recently opened at Rogerstone, Monmouthshire, by Northern Aluminium Company Limited. This plant, which cost £3,500,000, has been built to help the aluminium industry to maintain existing and develop new markets. In brief, it is designed to produce better quality material at lower prices.

The output capacity of the new plant is 50,000 tons per annum, that is, one-half of the peak production figure from all British plants during the war. It is expected to increase present British aluminium sheet rolling capacity by no less than 35 per cent. To allow this output capacity to be used with the maximum of economy, long production runs are essential. Therefore, the plant has been specifically designed to deal with only two materials, commercially pure aluminium (Noral 2S) and a 1¼ per cent. manganese alloy (Noral 3S). The chief products of the mill are to be container sheet, corrugated sheet and building sheets of all kinds.

There is ample scope for further expansion if required. Space is available for extending the cold rolling and finishing facilities to absorb the full capacity of the hot line, which is at present expected to operate on only one shift per day. In addition, if it becomes desirable to produce strong alloys, such as those needed in automobile and aircraft practice, there is provision for two additional mill stands in the hot line.

General Layout

A diagram of the layout is given in Fig. 1. The ingot for rolling, either imported from Canada or cast in the Remelt Department, is first "scalped" to remove surface roughness. From the scalping machine it passes to a pre-heating furnace and thence down the hot line for successive hot rolling through two independent reversing mills followed by passes through two hot finishing mills operated in tandem. The sheet is end-sheared and side-trimmed in process before being coiled at the end of the hot line. After a cooling period the coil is transferred to the cold rolling mill where it is passed through three mills operated in tandem. Subsequent treatment is governed by the use for which the sheet is required.

Coil to be used as building sheet is passed to the heavy shear line where it is flattened, cut to length and corrugated if required. Coil for any other purpose passes on to a slitter where it is edge-trimmed or slit into strips. Strip intended for "circles" for hollow ware goes to the circle mill where the discs are cut on a blanking press. Other material is passed through an annealing furnace. After annealing, foil stock is in the condition required by the customer, but container sheet is rolled to the desired hardness in a temper mill before being delivered to the light shear line for de-greasing, edge trimming, checking for gauge and quality, cutting to length and, finally, sorting.

Remelting

To take full advantage of the high cold rolling speeds and continuous sequence finishing machinery, very long coils are needed. Consequently, correspondingly large ingots are also essential. Aluminium is usually imported in the form of "pigs" weighing about 50lb. each. These pigs have then to be re-melted and cast into ingots. To eliminate this process, ingots up to 4,000lb. weight are received direct from the Canadian reduction plants. For this reason the remelting equipment installed in the Rogerstone continuous strip mill deals only with process scrap, trimmings, offcuts and rejected sheets, which is mainly of thin gauge material.

Low frequency electric induction furnaces are particularly suitable for melting this class of material. The heat is generated in the metal itself and rapid melting is obtained. Furthermore, the strong circulation induced in the molten metal ensures effective mixing. This, in conjunction with the

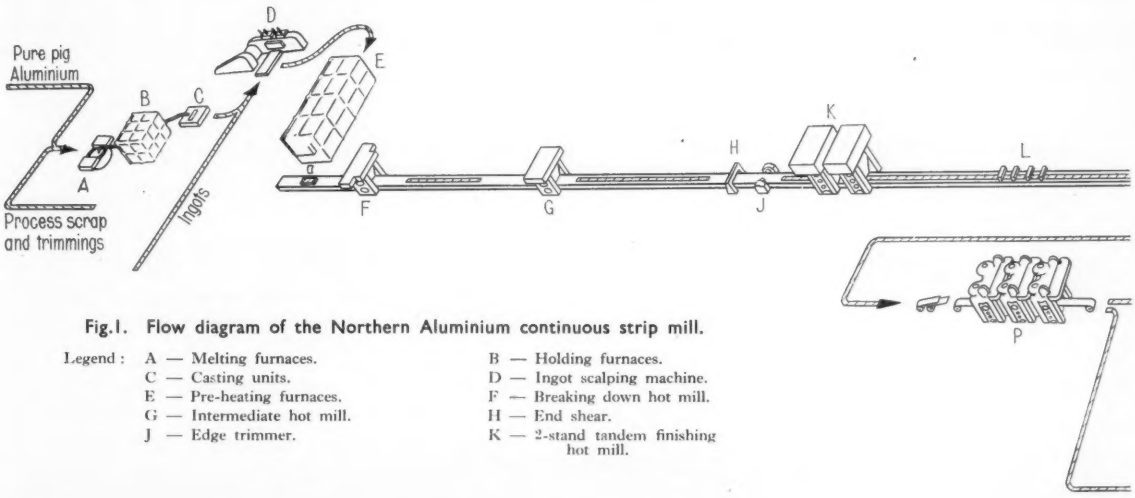


Fig. 1. Flow diagram of the Northern Aluminium continuous strip mill.

Legend: A — Melting furnaces. B — Holding furnaces. C — Casting units. D — Ingot scalping machine. E — Pre-heating furnaces. F — Breaking down hot mill. G — Intermediate hot mill. H — End shear. J — Edge trimmer. K — 2-stand tandem finishing hot mill.

fact that the surface temperature of the metal is kept relatively low, reduces oxidation losses to a minimum.

The high initial cost of these furnaces makes it desirable from an economic point of view to keep them melting at their maximum rate for as much as possible of the available time. In addition, when they are not working at full power there is some tendency for choking to occur in the narrow channels through the induction coils. In order that the best use may be made of the low frequency electric induction furnaces, simple electric resistance heated holding furnaces have also been installed. The charge is siphoned into these as soon as it is completely melted. In these furnaces the metal can be maintained at a steady temperature, if this is required for any purpose such as checking the chemical composition before casting.

From these furnaces it is possible to cast sound rolling ingots even when the charge is made up completely of process scrap without the addition of virgin materials. The well-known semi-continuous casting process is used. In this process the metal is poured from the furnace into a water-cooled mould, the base of which is slowly lowered by a hydraulic ram as the metal solidifies. Each of the two machines installed is capable of casting 9,000 lb. of metal. That is more than double the weight of the ingots normally required in the mill. Therefore, ingots are cast in pairs.

Preparatory Processing

To ensure the highest standard of surface finish on the final sheet product, it is the normal practice to machine both faces of the ingot. This operation is usually referred to as "scalping". A large milling machine (Fig. 2) has been installed for this duty. It is capable of machining a face 10ft. long × 5ft. wide. Loading, turning over and unloading are all effected mechanically by means of hydraulically-operated tables. The complete operation on both sides of a large ingot can be effected in less than five minutes.

The temperature for hot rolling aluminium lies within the range 420 deg. C. to 550 deg. C., according to the alloy. Further, an ingot of pure aluminium is ready for rolling as soon as it is heated to the rolling temperature, but some of the alloys require a soaking period. There are four pre-heating furnaces, two gas-fired and two electrically heated. All are of the "push-through" type, that is, the ingots are loaded on trays at the charging end and pushed through the furnace by a hydraulic ram. Part of the pre-heating equipment is shown in Fig. 3.

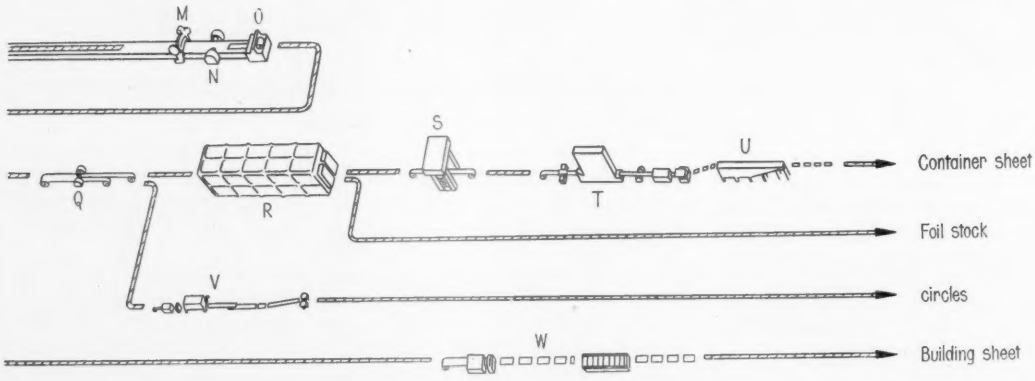
Pre-heating is carried out on the batch system. As a load of heated ingots is pushed out of a furnace one by one for rolling, a new batch of cold ingots is charged in. While this new batch is being heated to the rolling temperature, the mill is fed from other furnaces. For alloys which require a soaking period, the pre-heat capacity is at present sufficient to supply the hot line for only one shift. Provision has, however, been made for additional furnaces to allow the hot line to work continuously whatever the metal to be rolled.

Hot Rolling

Ingots are taken from the discharging end of the pre-heat furnace by an overhead crane-type discharger, which deposits each one in turn on to a tilting table (see Fig. 4). The tilting table lowers the ingot on to the live roll table when the mill operator is ready for it. It is then conveyed to the first mill for "breaking down". For this operation a 2-high reversing mill is used (see Fig. 5). It is driven by a 2,000 h.p. motor and has rolls 35in. diameter × 96in. long between which the ingot is rolled for five or more passes.

The first few passes may be carried out with the ingot "broadside", that is, entering the mill with its long axis parallel to the rolls. For this "broad-side-rolling" the ingot is turned mechanically on a section of the table where the rollers are divided in the centre. The lines of half-rollers are rotated in opposite directions. Final squaring up and centring of the ingot are effected by hydraulic manipulators situated on each side of the mill. The maximum width of slab that can be rolled on the hot line is 78in. When the rolled slab leaves the breaking-down mill for intermediate hot rolling, its thickness has been reduced from approximately 9in. to about 2½in.

From the breaking down mill the slab is carried down the roller table to enter the rolls of the intermediate mill. These are 32in. diameter × 84in. long and are driven by a 1,650 h.p. motor. On this mill, also, hydraulic manipulators on each side move in and out automatically as the mill reverses to ensure that all passes are taken on the centre line of the mill. On the ingoing side the manipulators close so that they give a passage only slightly wider than the slab width. On the outgoing side, they open out clear of the path of the slab. The



L — Cooling sprays. M — Edge shear. N — Edge trimmer.
O — Coiling machine. P — 3-stand tandem cold mill. Q — Slitter.
R — Annealing furnace. S — Temper mill. T — Light shear lines.
U — Classifiers. V — Circle line. W — Heavy shear line and corrugating machine.

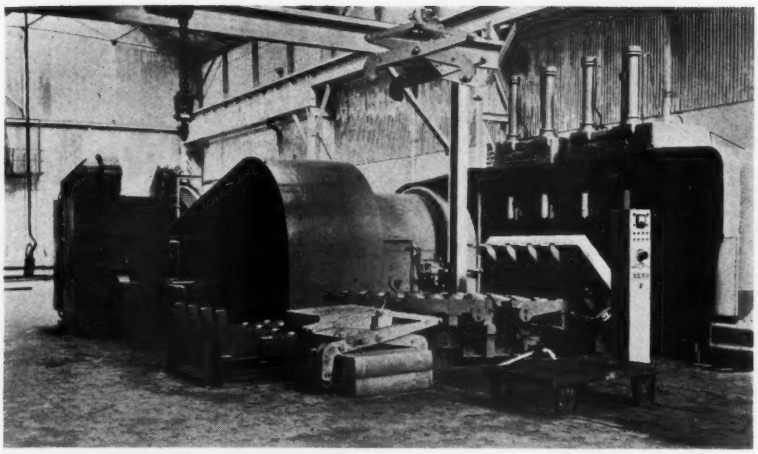


Fig. 2. Ingersoll milling machine with manipulating conveyors for scalping ingots.

intermediate mill is shown in Fig. 6.

The three or five passes normally given on the intermediate mill reduced the thickness of the slab, without altering its width, from 2½in. down to the finishing mill gauge, which ranges between 3in. and ¾in. At this stage, the slab which may be as long as 150ft., travels to an up-cut shear which trims the front end. It then passes to an edge-trimming machine where any end cracks which may develop during the rolling of the harder alloys are cut off.

From the edge-trimming machine the slab passes to the hot finishing mill (Fig. 7) to be rolled down in one pass to the gauge required in the final hot-rolled coil. This is carried out in two 4-high stands in tandem, each with work rolls 24in. diameter and back-up rolls 56in. diameter × 88in. long. The first stand is driven by a 3,000 h.p. motor and the second by one of 2,600 h.p. At a maximum the outgoing metal may reach a speed of 800ft. per minute. The reduction effected in the hot finishing mill may be in the order of 80 per cent. to give a final product length of 600ft. Final thickness, depending upon the use for which the material is intended, is in the range 0.100in. to 0.250in.

From the finishing mill the slab passes on to a 700ft. table. This has 235 individually-driven rollers (see Fig. 8) for carrying the slab down to the coiler at the end. On its passage down the table, the slab passes under a cooling bank where sprays of water reduce its temperature sufficiently to allow coiling to be carried out without damaging the surface of the metal. Before the slab reaches the coiler, a down-cut shear trims the front end and a side trimmer removes any edge cracks. A 3-roll up-coiler (Fig. 9) completes the hot line. On it the slab is evenly coiled and then discharged on to a conveyor which carries it to a weighing machine and thence to a collecting table. From there coils are lifted six at a time by an overhead crane with a special lifting beam and placed on rails where they are allowed to cool before cold rolling.

Cold Rolling

Coils to be cold rolled in the new mill are deposited six at a time on a slat conveyor for transference to a tandem cold rolling mill, through which every coil passes, irrespective of the purpose for which it is finally intended. Before a coil is fed into the mill the outside end has to be flattened to form a straight "tail". The first few feet of the coil are roughly straightened against a steel drum in a "spragging" machine and the "tail" thus formed is fed into a reversible roller leveller which lengthens it, after which a shear squares up the end. When this is completed the coil is pushed on to a slat conveyor which carries it up to the entry end ofthe mill ready for rolling.

A three-stand 4-high tandem cold mill is used. Its outstanding characteristic is its high speed, the strip coming from it at 2,000ft. per minute. The length of the coil will then be in the order of 3,500ft. On this mill the maximum width that can be rolled is 54in.

Tandem rolling is an operation of great complexity and calls for considerable operational skill. In the

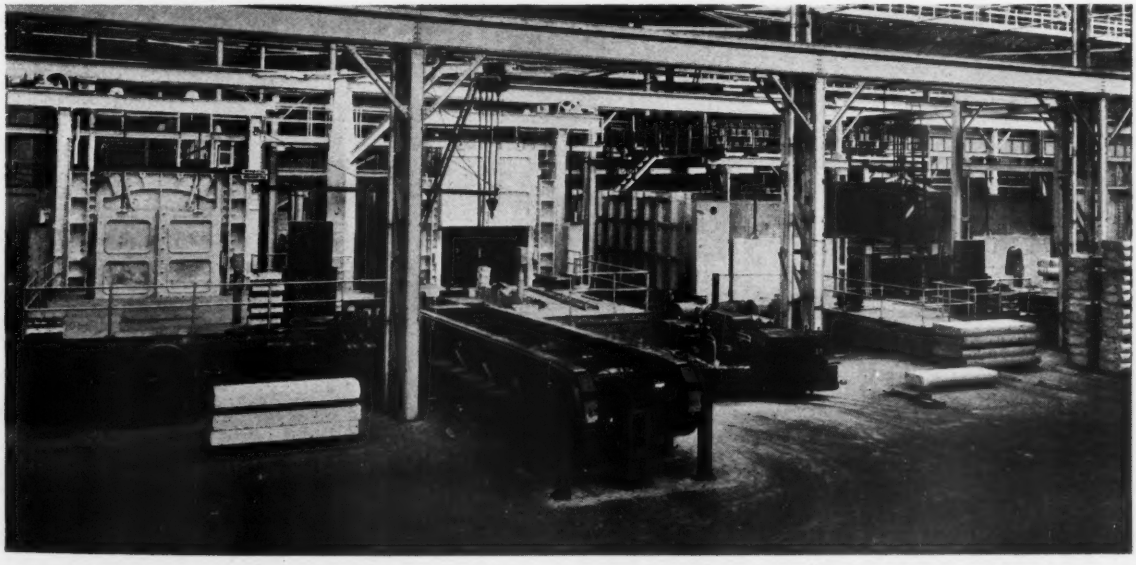


Fig. 3. Ingoing side of pre-heat furnaces. The transverse conveyor is for transferring ingots to the furnace charging track.

new mill the skill of the operator is reinforced by the most complete and up-to-date equipment. To start, the coil is fed into No. 1 stand through an interlocking roller bridle which holds it under tension and keeps it in the centre of the rolls. It is then passed to Nos. 2 and 3 stands, over a deflector roll, and re-coiled on a driven collapsible reel. The whole mill runs at a relatively low speed until the reel has been wrapped with several turns. All three stands together with the reel are then accelerated as a unit up to the proper rolling speed. The speed of each stand is adjusted to suit the increasing length of the strip. The strip is kept tight and under tension between the stands and between No. 3 stand and the reel. During the accelerating period special electrical devices are employed to maintain the correct tension and so control the final gauge of the strip and avoid the danger of breakages because of excessive tension.

Depending upon the alloy, the reduction taken at one pass through the mill may be as much as 90 per cent. At this reduction the maximum delivery speed from No. 3 stand is slightly over 2,000ft. per minute. Some alloys work harden more quickly than others and do not permit such heavy reductions to be taken because of the excessive edge-cracking that may occur. Such alloys are given two or more lighter reductions with intermediate annealing operations. Rolling oil is applied freely both as a coolant and a lubricant. The careful selection of this oil and its maintenance in a clean condition are important factors in the production of high quality cold rolled strip.

When rolling is completed, the coil is ejected from the reel and passed mechanically on to an inclined V-conveyor and weighed. Subsequent routeing of the material depends upon the nature of the finished product. Coil required for building sheet is transferred by crane to the heavy shear line while coil for other purposes is passed forward to the slitting line.

Slitting

Coils for foil stock, container sheet and circles are passed forward from the cold rolling mill to a slitting machine (Fig. 10), used for edge trimming the coil to final width and also, if required, slitting the coil into two or more strips. Edge trimming is applied to foil stocks and slitting to coils for container sheets and circles. The coils for container sheets are rolled in multiple widths on the hot line and three-stand tandem mill and must be slit to final width, not more than 30in. before temper rolling. Coils for circles are usually slit into six or eight strips of 8in. maximum width.

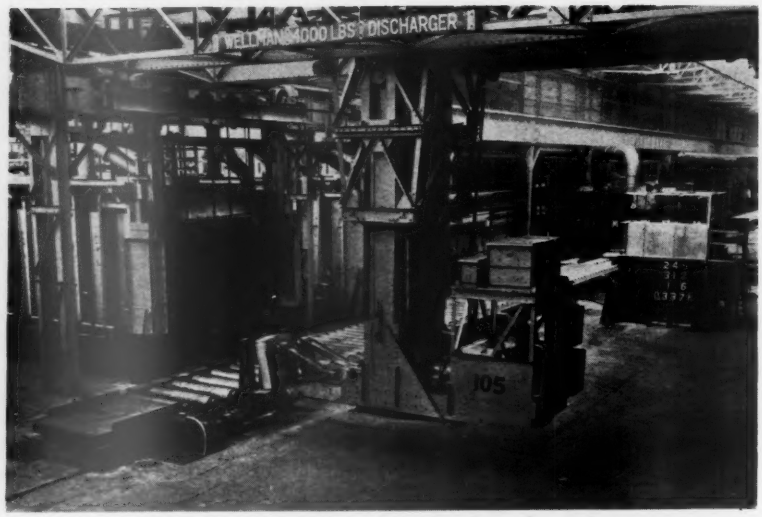


Fig. 4. A pre-heated ingot on the tilting table from which it is lowered to the live rolls for transfer to the breaking down mill.

The coil is fed by a mechanical charger on to a pay-off reel which has a drag generator. This applies tension to the strip as it enters the rotary slitting cutters and is wound on to the reel at the other side. At the exit end of the machine there are two reels so that each half of a bisected strip can be coiled separately. The coil on each tension reel is ejected mechanically and passed over a weighing machine on to a slat conveyor. Edge trimmings fall into a tunnel and are rolled by means of a scrap baler into a shape convenient for subsequent remelting. After passing through the slitter, coils for container sheet and foil stock are transferred to the annealing furnace.

Annealing

Cold rolling of aluminium has the effect of increasing its hardness and reducing its ductility. Therefore, in order that further cold working can be carried out, it is necessary to soften it by annealing. This is effected by heating it up to and maintaining it at a temperature in the range 350-400 deg. C. The optimum temperature and the soaking period depend mainly on the type of alloy. This also determines the method of cooling. Some alloys are discharged direct from the annealing furnace into the shop atmosphere, whereas others are allowed to cool slowly in the furnace.

Foil stock is normally annealed at final gauge, which is usually about 0.018in. before despatch to the foil roller where they are received in condition suitable for further cold

Fig. 5. The breaking down mill.

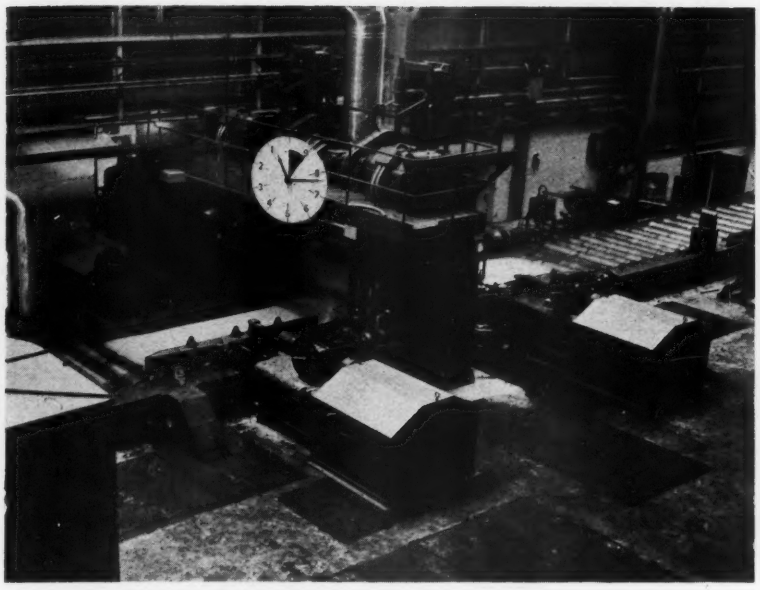


Fig. 6. The intermediate hot mill. The automatic centring guides can be seen on both sides of the mill.

rolling to foil gauges. In the production of container sheet the annealing is carried out at an intermediate gauge and the coils are then passed by conveyor to the temper mill.

A gas-fired annealing furnace is used. It has two parallel chambers heated by hot air from a gas-fired heat exchanger alongside. The coils, which are mounted on the steel spools on which they were mounted at the slitter, are loaded into trays. These trays are pushed hydraulically through the chambers of the annealing furnace. It is the usual practice to load the coils horizontally and in two tiers. A travers car at each end of the furnace connects with the loading and unloading track which is under a crane. This crane is used for loading and unloading the coils during the passage of the trays along the track.

Temper Rolling

The mechanical properties of the work-hardening aluminium alloy depend upon the degree of reduction given by cold rolling after annealing. Container sheet may, therefore, be given any desired temper by rolling to a pre-determined percentage reduction. This reduction may vary between 30 and 60 per cent. It is carried out in a temper mill.

Temper rolling is carried out in a single stand 4-high mill with rolls 12in. and 32in. diameter × 36in. long. The strip is passed through in one direction from one reel to another. Tension in both the ingoing and outgoing strip is controlled electrically. Speeds up to 2,000ft. per minute are reached and the coil may be about 5,500ft. long, but not more than 30in. wide. An essential condition of this final rolling operation is that the product shall be perfectly flat and of uniform gauge. This is ensured by the stiff rolls and the correct tension. To maintain a check on the gauge the mill is fitted with an instrument that is controlled by the resistance of the material to radiation from a radioactive isotope.

As in the tandem mill, care is necessary in the selection and treatment of the rolling oil. As a rule the oil for temper rolling is rather lighter because the gauge is thinner and the reductions smaller. In choosing and applying the lubricant, it is borne in mind that the final product must

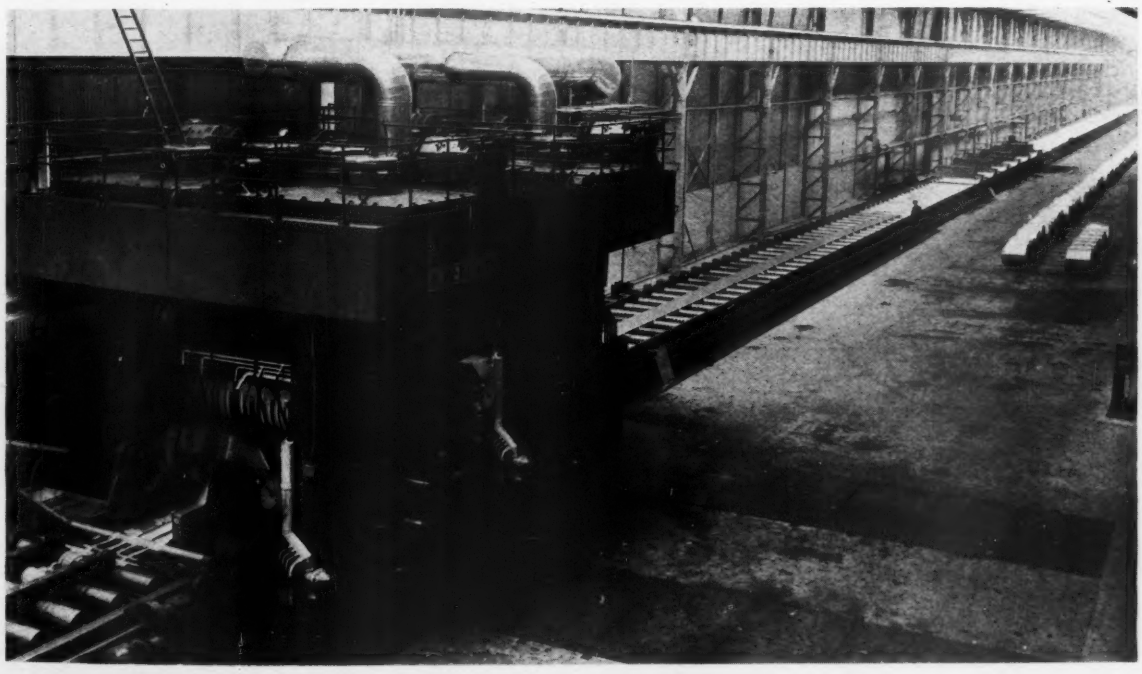


Fig. 7. The 2-stand tandem hot finishing mill.

be delivered to the customer in a clean condition. Therefore, excess oil remaining on the strip after temper rolling must be such as can be easily removed in a subsequent cleaning operation. Coils are moved to and from the temper mill mechanically. An overhead crane picks them up from the discharge conveyor six at a time and delivers them to the next operation.

Light Shear Lines

Coil for the production of light-gauge sheet is transferred from the temper mill to one of two light shear lines for cutting up. It is fed mechanically on to a pay-off reel, and to eliminate hand-threading of the machine, a continuous strip is created by spot welding the front end of each coil to the back end of the previous one. The metal passes through the line at speeds up to 600ft. per minute.

The strip is first drawn through a de-greasing plant that removes the excess rolling oil, leaving just the correct amount of oil on the surface to provide lubrication for subsequent operations in the customers' works. An edge trimmer is included in one of the light shear lines for any final trimming that may be required at this stage. After edge trimming, the strip is passed through a flying micrometer that provides a continuous check on the gauge. The strip is also inspected for surface quality before it reaches a roller leveller and then a barrel-type flying shear that cuts into the required sheet lengths to an accuracy of 1/32in.

Cut sheets pass through a classifier which separate piles according to quality. This is effected by passing the sheets over a series of conveyors which are provided with two gates. Scrap sheets, that is off-gauge material detected automatically by the flying micrometer, or material which has been rejected by visual inspection, pass through the first gate. Sheets of doubtful quality which the inspector wishes to re-examine, pass through the second gate. Prime quality sheets pass over both gates and are delivered to a third pile where they are automatically counted and stacked ready for packing and despatch.

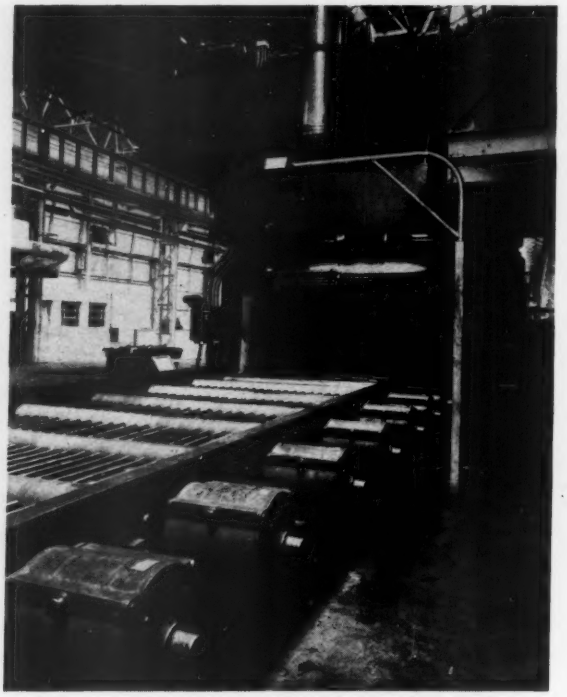


Fig. 8. The outgoing side of the hot finishing mill, showing part of the run-out table and some of the 235 electric motors each of which drives a single live roll.

Sheets from the "doubtful" pile which are to be givena closer inspection are delivered to the sheet inspection line. There an automatic de-piler, equipped with vacuum cups, picks up one sheet at a time and feeds it on to the inspection conveyor. From this conveyor the sheet is picked up and turned over by a spoked wheel, thus both sides are displayed to the inspector. By pressing a button, the inspector can divert any scrap sheets through a gate in the conveyor after they have left the inspection wheel. Good quality sheets are carried over to a pile where they are counted and stacked ready for despatch. This line can deal with 4,500 sheets per hour. This is estimated to be at least six times as fast as manual handling.

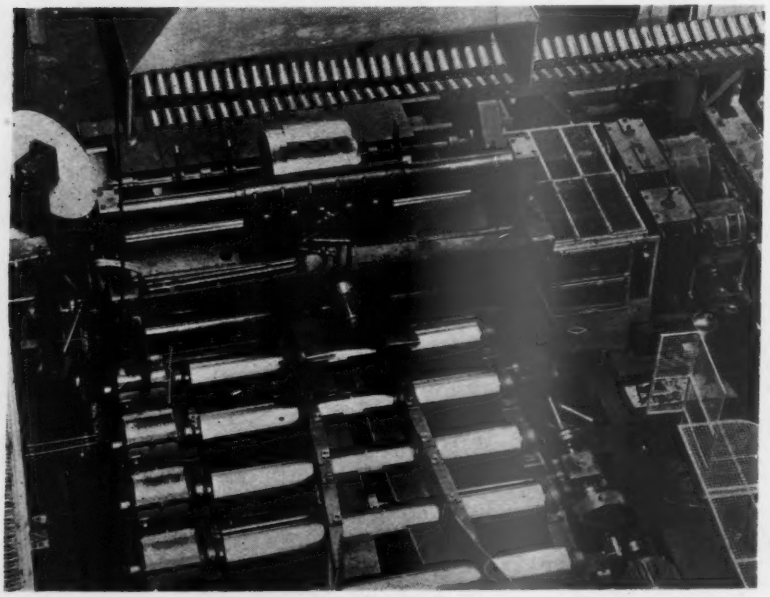


Fig. 9. The 3-roll up-coiler at the end of the hot line.

Circle Blanking

Coils for blanking into circles are delivered from the slitter to a high speed blanking press. This has mechanised handling equipment on both the ingoing and outgoing sides. It is intended for long runs, particularly in the smaller sizes and lighter gauges. Blanking can be carried out at rates varying from 250 to 500 circles per minute, depending on size. The coil, maximum width 8in., is delivered on to a spool as it comes from the slitting line. Several narrow coils may be wound at the slitter on to one standard length spool.

The coil is first unwound and straightened by being passed through a roller leveller. It is then taken through a continuous gauging instrument to the press. Blanks are carried over a series of conveyors while the scrap is wound up mechanically on

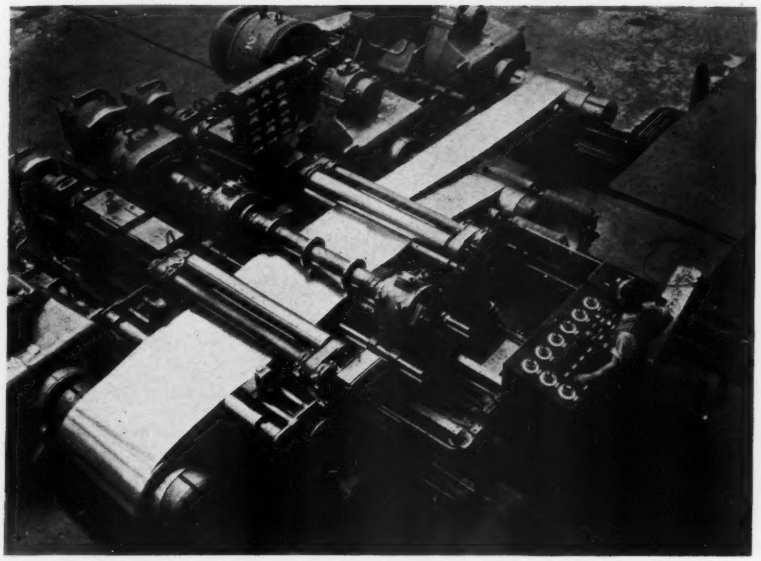


Fig. 10. Cutting coils to desired widths on the slitting machine.

the outgoing side of the press. A diverter gate delivers any off-gauge circles to scrap boxes. On-gauge circles are carried forward for visual inspection. Any circles rejected at visual inspection are removed from the conveyor by hand. The others are automatically counted and stacked into convenient bundles before being transferred to the containers in which they are despatched.

Heavy Shearing and Corrugating

Medium gauge sheet, 0.022in.-0.064in., is rolled down to final gauge in the tandem mill and then delivered direct to the heavy shearing and corrugating line. There the coil is straightened by unwinding it from the cones and passing it through a roller leveller. After being straightened, the material is cut into sheets of the required size in a reciprocating-type flying shear. These sheets are then delivered on to a belt conveyor.

Sheets which are to be corrugated on the roller machine are delivered by conveyor and stacked after corrugating. Those which are to be delivered flat or corrugated in some other type of machine are stacked as they are delivered from the flying shear. All sheets from the heavy shear line are thoroughly inspected before despatch.

Since the hot line can process more than the cold mill, hot rolled slab can also be supplied. This will be mainly in pure aluminium, but a certain amount of $1\frac{1}{4}$ per cent. manganese alloy may be available. The maximum width of hot rolled slab is 78in. and its thickness is usually between 0.10in. and 0.25in.

This new mill is a major industrial development of great importance to many industries. It is also evidence that British designers and manufacturers can produce equipment that will bear comparison with that of any other country.

CORRESPONDENCE

Correspondence on subjects of technical interest is invited. The name and address of the writer must be given, though not necessarily for publication. No responsibility is accepted by the Editor for the opinions of correspondents, and the right is reserved to omit any portion of a letter. If a reply by post be desired, a stamped addressed envelope should be enclosed.

HEAVY VEHICLE SUSPENSION

SIR,—In the October issue you comment in the Commercial Vehicle Show Review and in the chapter "Suspension", that there are rather few new developments.

Having the opportunity of comparing some English 'buses with 'buses from other countries, I have found that the English 'buses need better suspension. The 'buses are of a high quality, but the hard springs make them less comfortable to ride in. As the other 'buses also have leaf springs, it shows that the English makers do not do the utmost possible in the way of building leaf springs. In remote places, which have not a well supplied store or repair facilities, it seems better to have leaf springs than more intricate suspension systems.

OLAV UTNE.

Norway.

BONDED BRAKE LININGS

SIR,—With reference to the review of the Commercial Motor Show in the September/October issue, I would refer you to the section on brakes, in which it is stated, referring to moulded linings:

> "The Girling Company uses this material, which is in most sizes bonded to the shoes instead of being secured by rivets".

This statement is not in accordance with the facts and would, I feel, give a completely wrong impression in the mind of the reader as to the degree of popularity which the process of bonding brake linings to brake shoes has achieved.

I think I am right in saying that bonding has not been adopted on any commercial vehicle as original equipment, and on only one private car.

D. J. LANE.

London, S.E.1.

DETAIL REFINEMENT

SIR,—Regarding the Editorial in the August issue of *The Automobile Engineer*, I read this with great interest and must agree your criticisms are in my opinion justified. The practice of drawing in so-called fresh air, low down at the front of the car is obviously wrong. The solution is without doubt to provide an air intake in the header panel of the roof which can be controlled to diffuse the air downwards on the inside of the windscreen and circulate this air gently through the car. This also acts as a good medium for removing condensation on the glass.

We have carried out a lot of development work in this direction and have a fitment which is simple, operating in all weathers and controllable by the driver. Thus we have a fresh-air device used in conjunction with a heater which when desired will heat this fresh air and not use the foul, dust-laden air drawn in from below the windscreen level.

WEATHERSHIELDS, LTD.
W. H. BISHOP,
Managing Director.

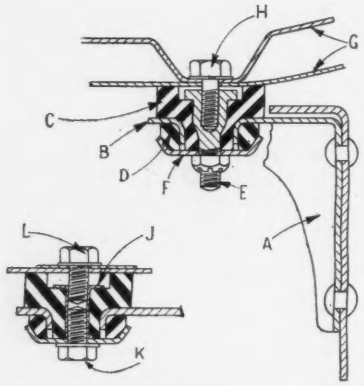
Birmingham, 4.

CURRENT PATENTS

A Comprehensive Review of Recent Automobile Specifications

Resilient Body-Mounting Connections

TO eliminate noise and vibration between two large and relatively movable objects, such as an automobile body and its chassis, it has been common to separate the two components by pads of rubber which were either positioned manually during assembly or were made to adhere to one of the components before assembly. In the case of relatively large structures involving a number of such pads, manual positioning was found to be unduly expensive whilst attached pads were liable to be displaced or removed accidentally during the process of assembly. Moreover, bolts extending through the pad were in direct contact with both components and noise was transmitted from one to the other. These disadvantages are, it is claimed, avoided by the invention.



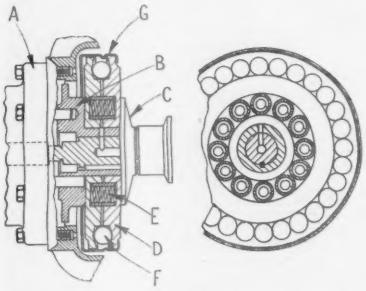
No. 626809

The support bracket A riveted to the chassis side frame has a pierced and extruded flange B. The mounting comprises moulded rubber annuli C and D seated respectively on the inner and outer diameters of the extruded boss of the flange B. A shouldered and socketed bolt E and a cupped washer F serve to secure the mounting to the support flange. The body structure G seats on the upper face of annulus C and is positioned by bolt H secured into the socket of bolt E.

In a modified construction, bolt E is replaced by a flanged and internally threaded sleeve J. The length of the attachment screws are so limited that there is no risk of screw K being loosened when the body screw L is tightened. *Patent No.* 626809. *Ford Motor Co., Ltd.*

Torsional Vibration Damper

INTENDED for engine-driven electrical equipment, the loading of this torsional vibration damper is increased proportionally as the speed of rotation is raised. In the example it is fitted to a generator A, on the shaft of which is keyed or splined a flanged sleeve B and a flanged collar C. Between the flanges is mounted a pair of damping discs D normally urged into frictional contact with the flanges by a plurality of helical springs E. Near the periphery the inner faces of discs D are cupped to provide a series of open-ended spherical sockets to receive steel balls F. As the speed of rotation is increased the balls are urged outwardly, tending to spread the discs and increase the frictional loading at the flanges. Lubrication passages are provided in the shaft and sleeve and an oil sealing member G may be fitted over the damping discs.



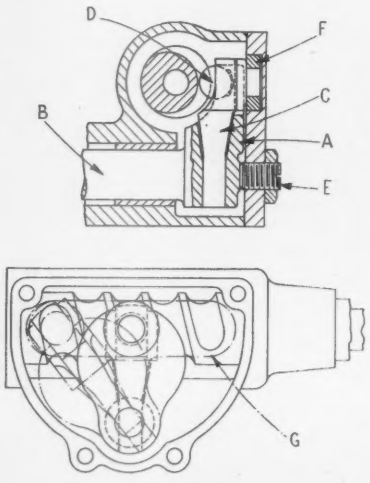
No. 623426

Although the specification and longitudinal section suggest individual cups for the balls the transverse section would seem to indicate a continuous recess and a full row of balls. *Patent No.* 623426. *Jack & Heintz Precision Industries, Inc. (U.S.A.).*

Steering Gear

IN this steering mechanism a varying velocity ratio is produced by a helix of constant pitch engaged by a follower mounted in a telescoping lever on the cross shaft and constrained to travel in a rectilinear path.

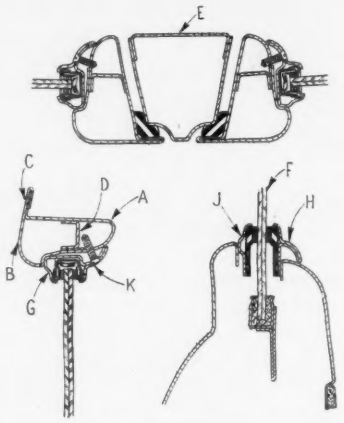
Lever A, formed on or secured to cross shaft B, has a radial bore in which is slidable the stem of member C carrying the ball follower D in a hemispherical seating. The operative end of member C slides in and is laterally supported in the bifurcated extension of lever A which is in turn supported by an adjustable abutment screw E. A spigot on member C projects between the arms of lever A and carries a roller F which is engaged in a guide slot G in the cover. *Patent No.* 626096. *Burman and Sons, Ltd. and W. H. Briggs.*



No. 626096

Mounting of Windows

TO facilitate body production this window mounting is assembled on the bench with the glass run and when inserted in the window opening provides exterior trim and interior garnish mouldings. The section diagrams show a mounting for a door window although a similar construction may be used for a windscreen, rear light or quarter lights. The upper run of the door is formed by inner panel A and outer panel B with an upwardly extending flange C providing a jamb face. Reinforcing these two panels is a channel rib D. Vertical edges of the door frame adjacent to the door pillar E are of the same general construction but the lower run is necessarily different as it must be formed with a longitudinal slot to accommodate the slidable window F.

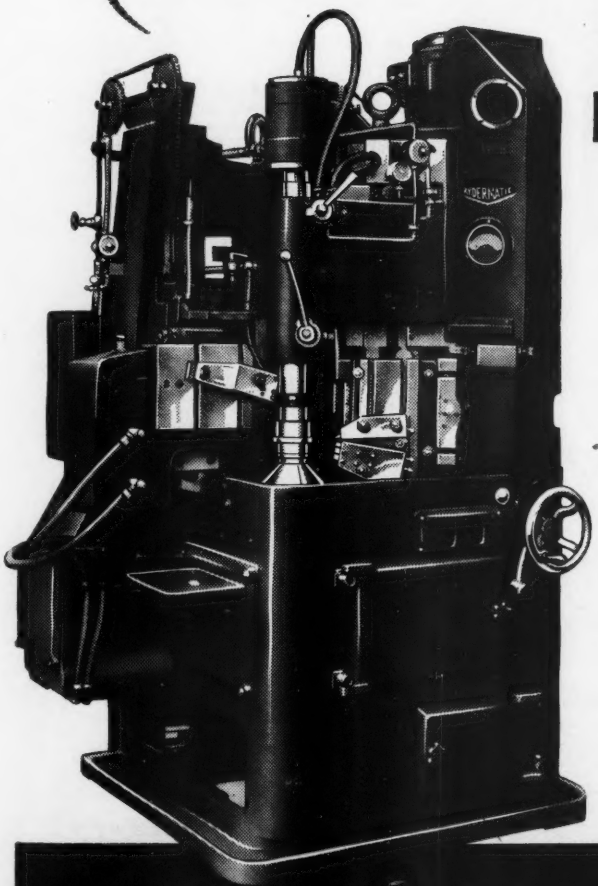


No. 627183

Window frame G is of a general channel section with an arcuate flange projecting inboard. This extends around three sides of the window and is completed to form a unitary structure by inboard and outboard sections H and J, welded along the lower side. A conventional glass run is mounted within the channel formed by the window frame either by springing open the flanges of the channel or swaging them over after placing in position. The inclined inner margin of outer door panel B facilitates the insertion of the frame in the window aperture and a two-point contact is established by the frame on the door. A plurality of screws K secure the frame in the door and on tightening slightly distort the arcuate flange and place the frame under stress which prevents subsequent loosening and consequent squeaks and rattles. *Patent No.* 627183. *Ford Motor Co., Ltd.*

Many motor manufacturers put their *HEAVY HIGH-SPEED CUTTING* jobs on the

RYDERMATIC



These single-spindle multi-tool vertical chucking lathes are particularly suitable for machining vehicle hubs, brake drums, clutch housings, flywheels, cluster gears, etc.

Ample power, great rigidity and smooth drive combine to allow full and effective use of tungsten carbide tools for heavy high-speed cutting. Vertical arrangement of the tool slides provides maximum accessibility for quick setting-up and changeover. The controls are few and simple and one unskilled operator can attend a group of several machines.

The No. 12 Rydermatic has a maximum chuck size of 15″ and takes up to 16″ between centres. The No. 18 accommodates 18″ dia. and up to 26″ between centres.

OUTSTANDING FEATURES

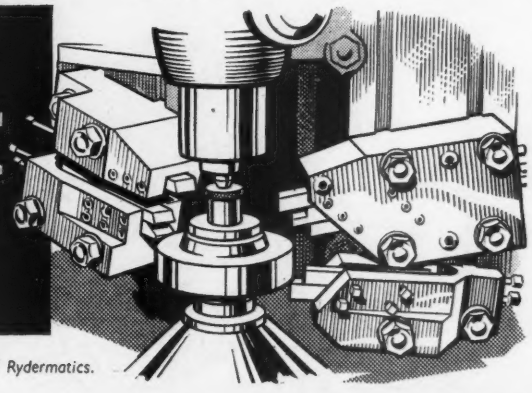
Easier loading and saving in floor space achieved by vertical construction.

Rigidity and power for heavy high-speed cutting with tungsten carbide tools.

Slides can operate at different portions of the time cycle.

Simple to operate, suitable for unskilled labour.

Speeds setting time, all toolslides being readily accessible.



Write to the Wickman Technical Publications Department for further details of Rydermatics.

Built by **THOMAS RYDER & SON LTD., BOLTON**

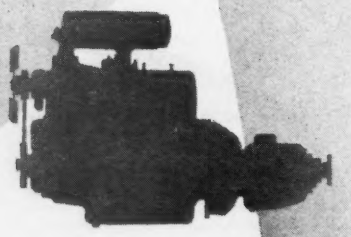
Sole Selling Agents

A. C. WICKMAN LTD., COVENTRY, ENGLAND

A.C. Wickman LIMITED • COVENTRY • ENGLAND •

37 F 18

The NEW Silentbloc FRUSTACON Mounting



This latest addition to the Silentbloc range has been designed to provide an engine mounting with a better performance at a lower price than any comparative type.

Of high load-carrying capacity and exceptional flexibility, the Frustacon has a range of deflection rates as wide as the engine designer could desire. The unusually large volume of rubber permitted by the Frustacon construction works in shear and compression. Compression pad (top) and rebound feature (bottom) are moulded in one piece.

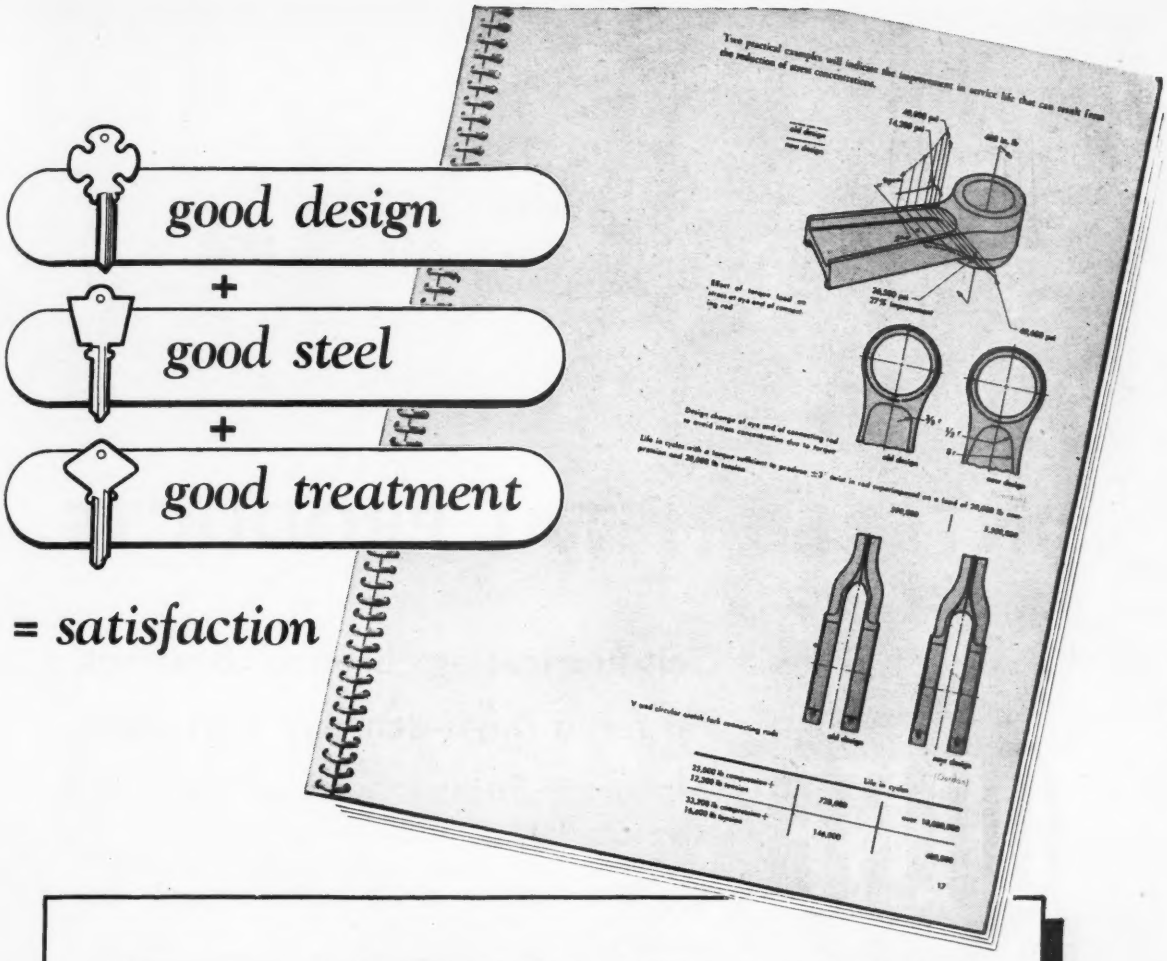
The mounting is low in height, compact, easy to fit and readily accommodated in engine layouts.

with the right deflection for every load

Write for Technical Information

SILENTBLOC LTD

VICTORIA GARDENS, LADBROKE ROAD, LONDON, W.11. TEL. PARK 9821



If you are a design engineer seeking success with steel components, you will find help towards your goal on every page of this 72 page booklet.

Write now for "3 Keys to Satisfaction"—it is valuable and it is free.

Climax Molybdenum Company of Europe Ltd.

Technical Enquiries: **99 Pinstone St., Sheffield 1**

(Registered Office: 2-3 Crosby Square, London, E.C.3)

BLOCK LETTERS PLEASE

Please send your **FREE Booklet** "3 KEYS TO SATISFACTION"

Name .....

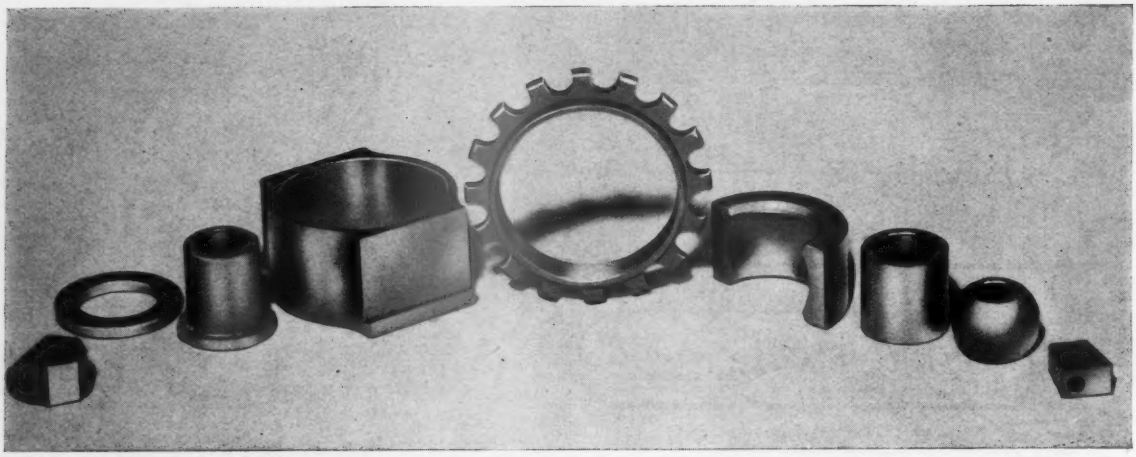
Position .....

Company .....

Address .....

AE 12

RR C21



SINTERED METAL PRODUCTS

OILITE

Self-lubricating bronze bearings.

Sintered (high-density) iron parts.

Sintered Superload bearings and structural parts.

Cored, solid and plate stock for machining.

Sintered metal filters.

Advantages gained from the above are :

HIGH OIL CONTENT ! ensures continuous lubrication.

HIGH STRENGTH ! oil provides a hydraulic cushion that absorbs shock loads.

NO OIL DRIP ! safe for TEXTILE & FOOD MACHINERY.

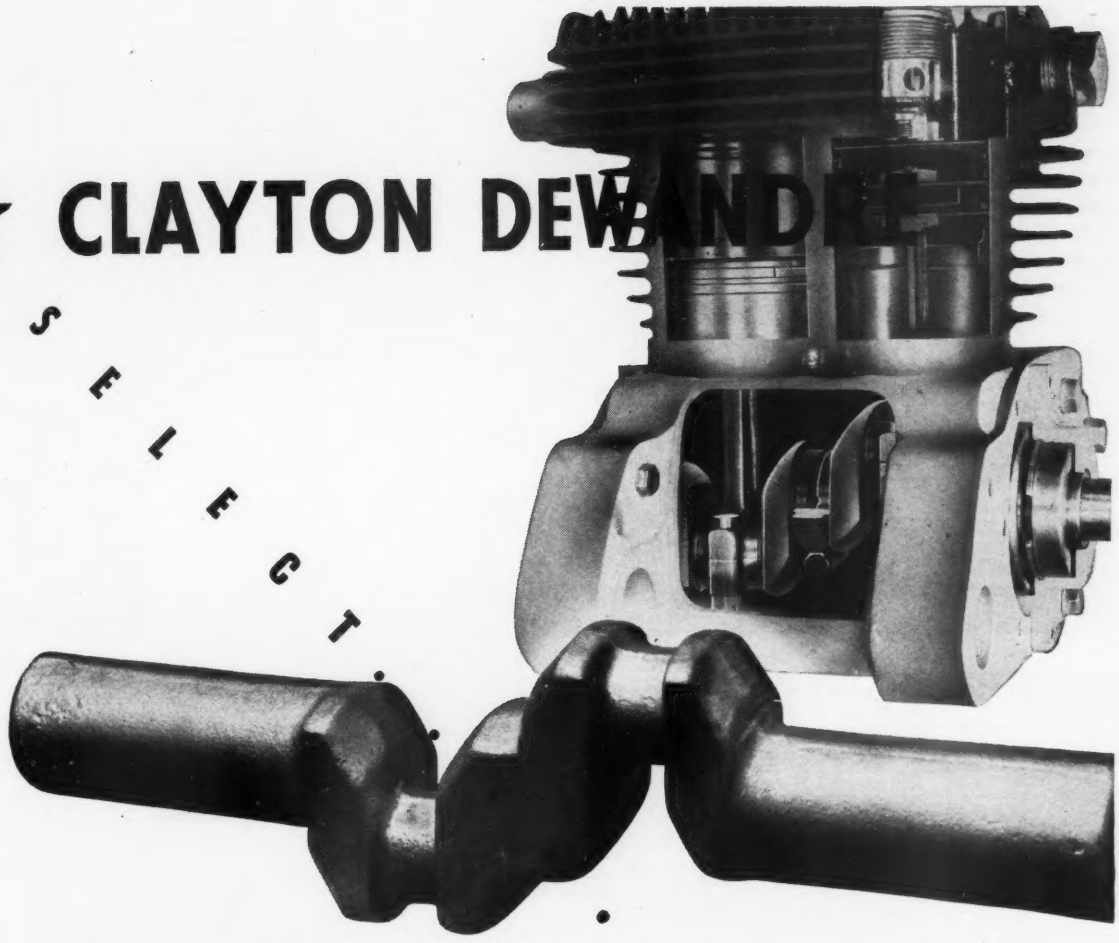
LOW COST ! OILITE is die-pressed to exact specification —no expensive machining required.

THE MANGANESE BRONZE & BRASS CO. LTD.
ELTON PARK WORKS, HADLEIGH ROAD, IPSWICH.

Telegrams : " OILITE," IPSWICH *Telephone :* 55415/55416

★ CLAYTON DEWANDRE

SELECT



SMETHWICK DROP FORGINGS

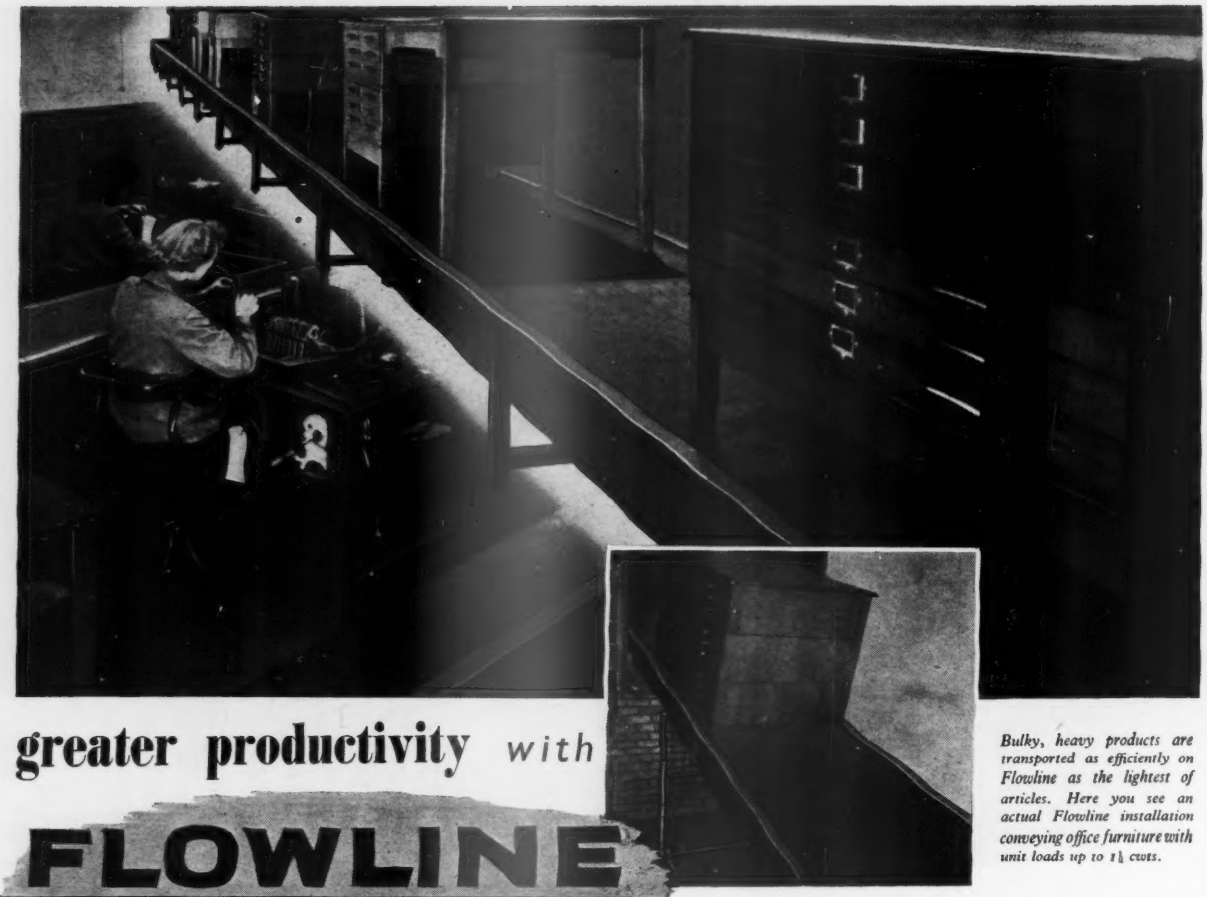
for incorporation into their well known air compressors because they know that . . .

* only highest grade materials are used
* the grain pattern is correctly disposed.

SDF

SMETHWICK DROP FORGINGS LTD

SMETHWICK AND KIDDERMINSTER ENGLAND



Bulky, heavy products are transported as efficiently on Flowline as the lightest of articles. Here you see an actual Flowline installation conveying office furniture with unit loads up to 1¼ cwts.

greater productivity *with*

FLOWLINE *VERSATILITY*

from a conveyor belt to an entire production line *in one system*

LOW COST — EARLY DELIVERY

EVERYTHING from a straightforward conveyor to a complete processing, assembling and packaging line, FLOWLINE can raise production to entirely new peaks.

It can be built up in units to include side benches, side tables, undershelves, footrests; it can divert production flow at right angles from one belt to another, use the lower belt strand as a return conveyor, rise on an *adjustable* angle of incline from 0° to 20° without the need for a separate belt.

As new production needs develop FLOWLINE can be expanded to keep pace. No other conveying system so easily adapts itself to every handling problem. Because of this and mass production of all parts, the cost of installing FLOWLINE is remarkably low.

A wide range of speeds is available and variable speed gears can be provided. All working parts are enclosed.

These, plus early delivery, are some of the reasons why more and more firms are installing FLOWLINE — and placing repeat orders — and why it will pay you to ask for the whole story.

FISHER & LUDLOW LTD

MATERIAL HANDLING DIVISION

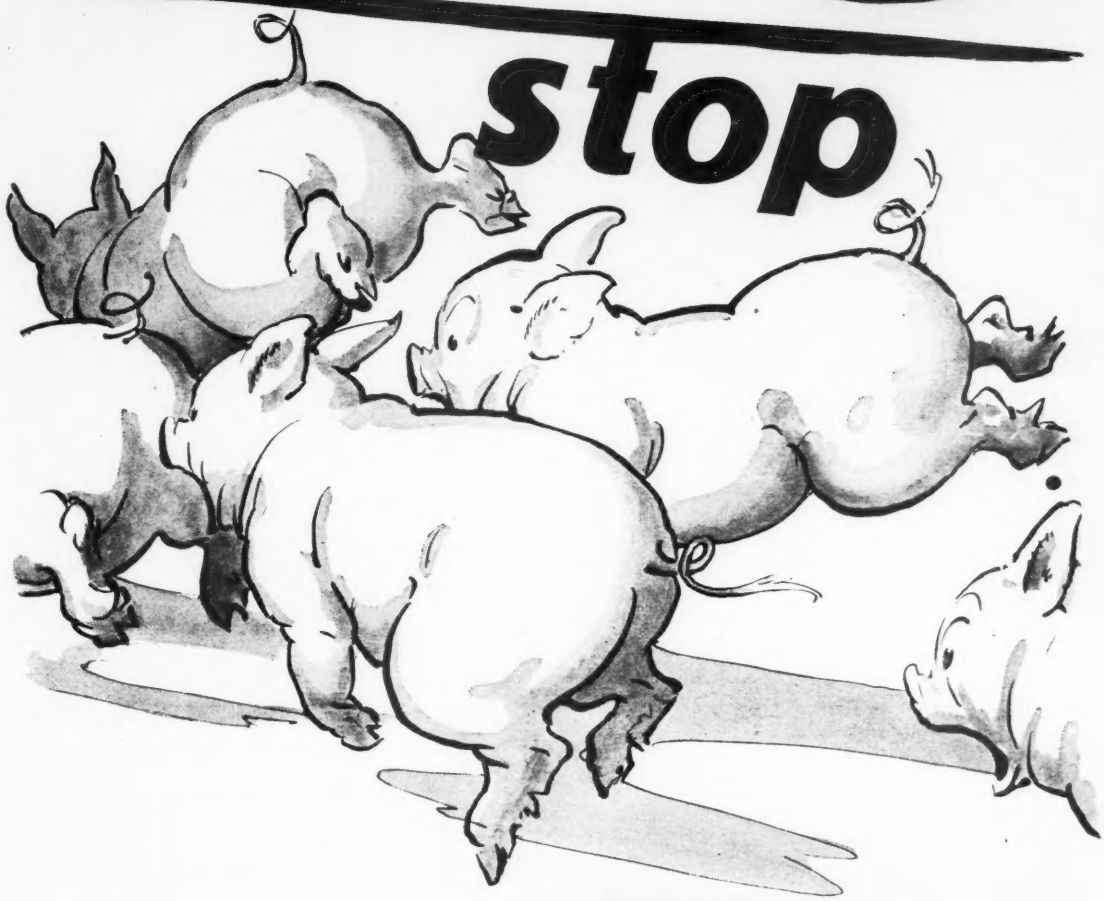
BORDESLEY WORKS, BIRMINGHAM 12. LONDON OFFICE: 46 BAKER STREET, W.1

Telephone : Victoria 2371 Telegrams : Flowline, Birmingham. Phone : Welbeck 5402/3 Grams : Fisholow, Wesdo, London

TAYLOR 2421

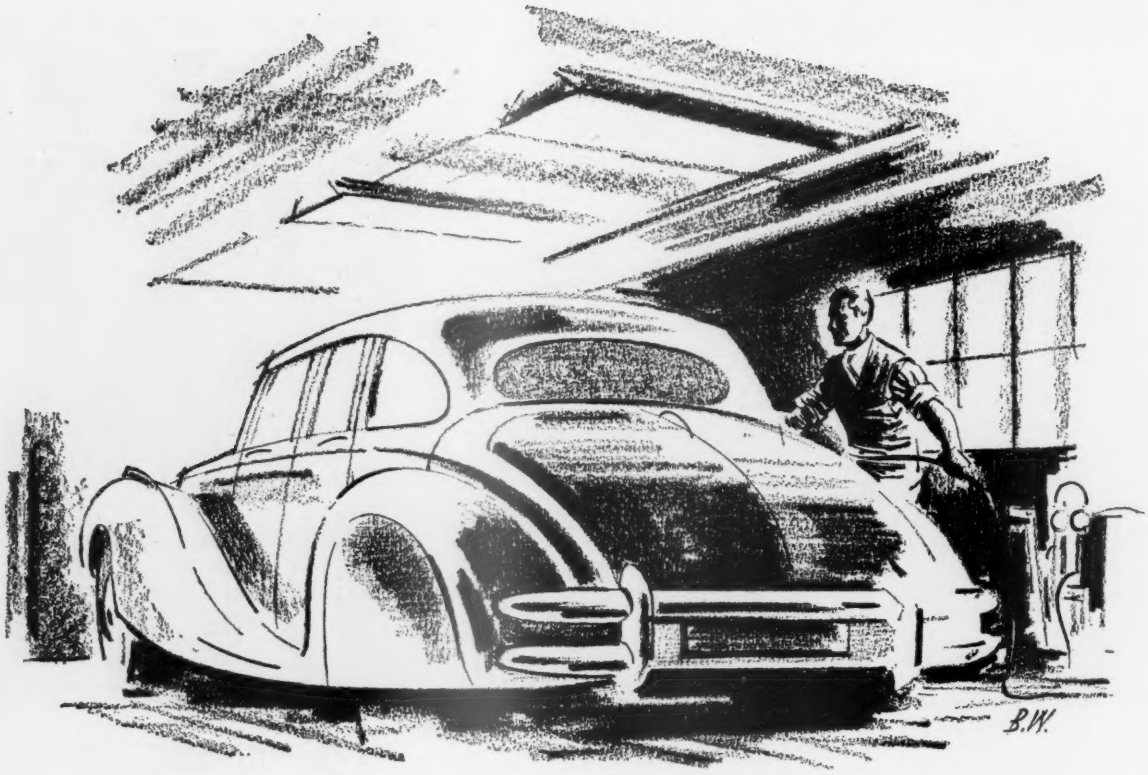
When you've got to

stop



you can rely on **MINTEX**

Mintex Brake Liners are manufactured by British Belting and Asbestos, Limited, Cleckheaton, Yorkshire and are available at all our Service Depots and Stockists.



Beautiful work is profitable business

In any market beauty has a powerful appeal. So a superb finish in a car is good business as well as good taste, as Manufacturers and Refinishers who use Proxcelin Finishes will readily agree. Proxcelin ensures a most brilliant, mirror-like gloss that is in the highest degree resistant to wear and weather. Used with the special Proxcelin undercoating and Proxcelin thinners and polishes, this range of finishes will give a sales boost to any model.

PROXCELIN

Cellulose Motor Enamel

A

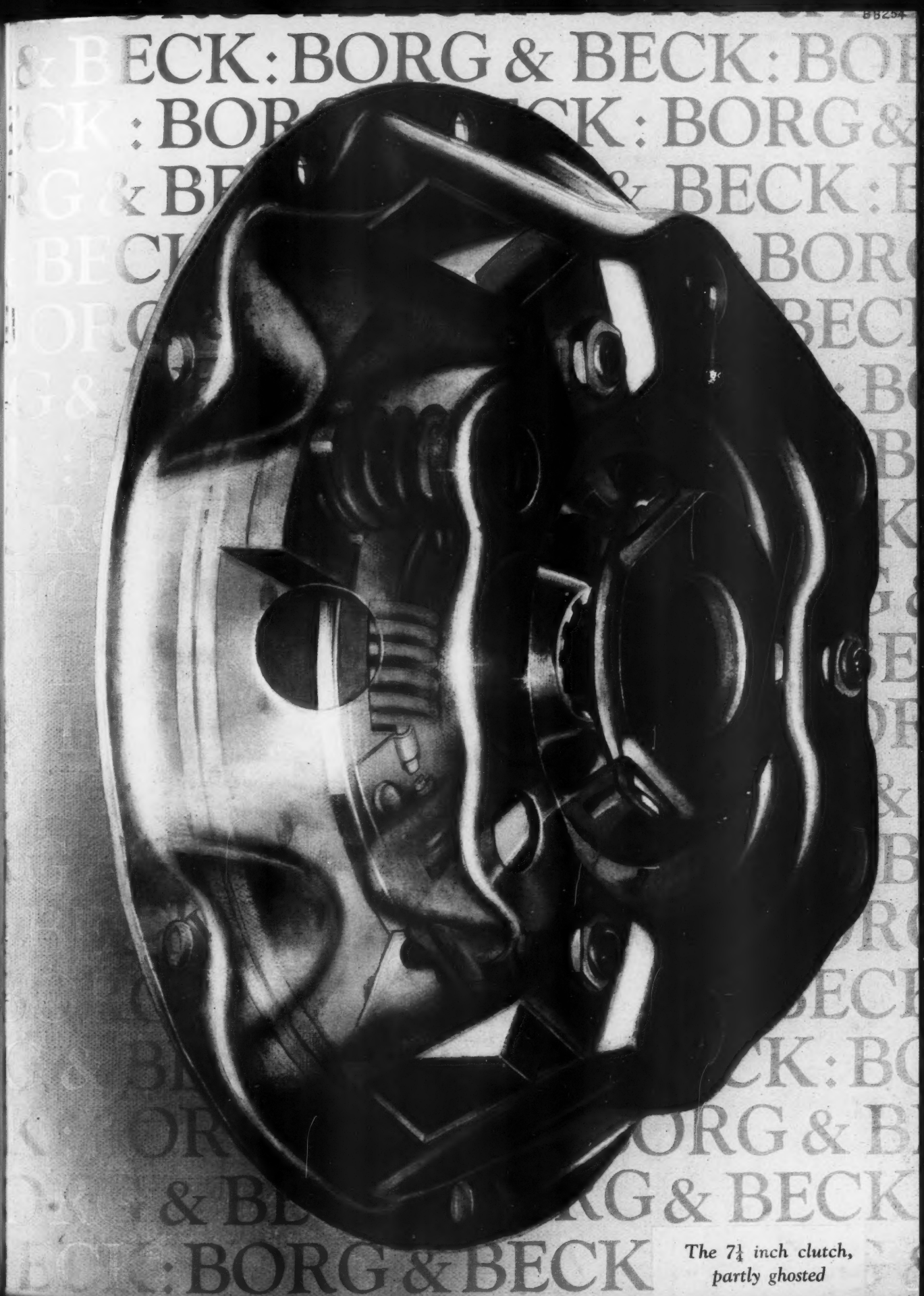
Berger

TRANSPORT FINISH

KEMITONE is the modern synthetic coach paint which gives up to twice the normal life on buses, trams, railway coaches, etc. All standard shades.

VITON Half-hour Enamels for air-drying on wood or metal surfaces. Ideal for re-finishing work.

50B/60



The 7¼ inch clutch, partly ghosted

FILTRATION

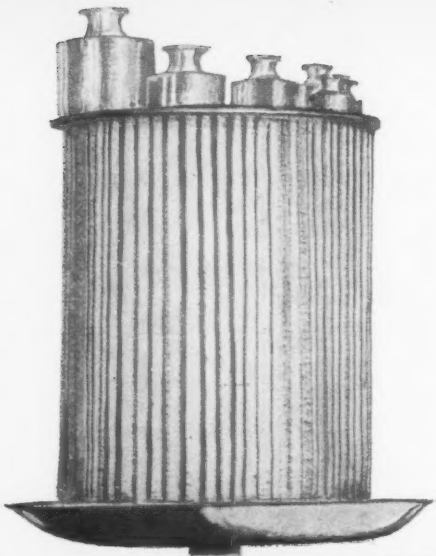
. . . it's the amount

Right from the inception of the Purolator micronic oil filter, the whole of the development work was focused upon arresting the maximum possible amount of micronic abrasives, and *maintaining* a high rate of arresting over a long period of useful filter life.

The proof of our success is shown by the weight of abrasive dirt arrested — the secret of

PUROLATOR

REGD. TRADE MARK



EFFICIENCY

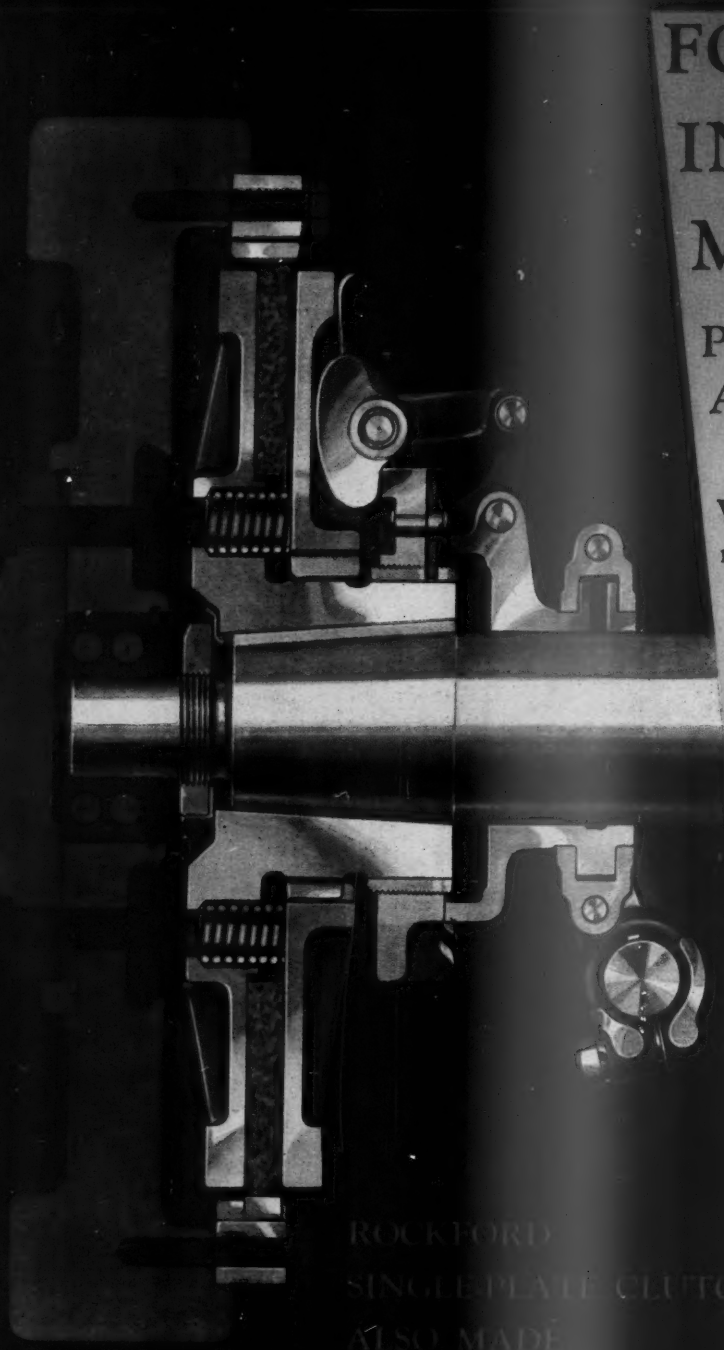
arrested that counts

successful filtration, and this success is due to the vast filtration area of the Purolator micronic filter and the carefully controlled texture of its plastic-impregnated element.

This filter can do a great deal to maintain the initial performance of an engine and thereby enhance the manufacturer's reputation for a durable product.

AUTOMOTIVE PRODUCTS COMPANY LTD., LEAMINGTON SPA

MICRONIC *Oil* FILTER



ROCKFORD
SINGLE PLATE CLUTCH
ALSO MADE
IN TWIN PLATE TYPE

FOR INDUSTRIAL MACHINES,

POWER TAKE-OFFS AND CLUTCHES

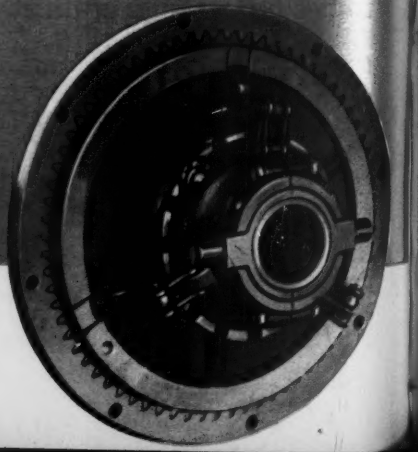
We are glad to announce that we are now manufacturing at Leamington Spa, a range of Rockford heavy-duty clutches and power take-offs for use in conjunction with industrial petrol, paraffin and diesel engines and machines such as portable generators, compressors, power shovels, pumps, excavators, winches and cranes.

These clutches are expressly designed and made for heavy duty, they have a basically balanced toggle action which holds the clutch firmly in the engaged or the running position without end thrust. An extremely simple and accessible device provides infinitely close adjustment without the need for special tools or the manipulation of special locking devices.

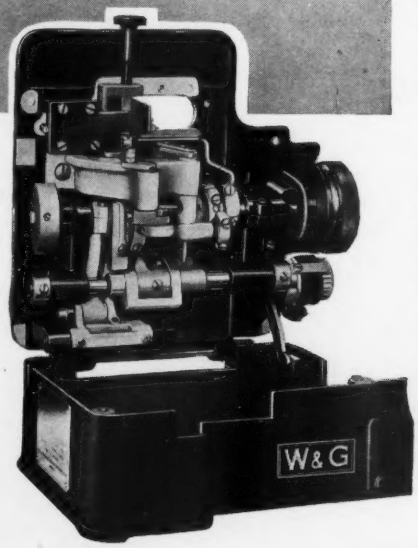
Descriptive booklet, with list of standard sizes, on application from:—

BORG & BECK COMPANY LTD.
Leamington Spa, England

ROCKFORD



"114 machining operations" - it has to be a good casting!



The frame for the W. & G. Overlock Sewing Machine represents a very difficult foundry operation, and Willcox and Gibbs S.M. Co. Ltd. say, in entrusting it to Harpers :—

"It requires 114 machining operations and has to be free from distortion and hard spots, and is required to be absolutely stable.

The multitude of cast components in the machine are mounted in close proximity to each other, and if considerable hand finishing is to be avoided, it is essential that the castings come to us absolutely true to pattern, with no variations whatsoever. Some of their components are extremely slender, with great variations in cross sections, which adds to the foundryman's difficulties.

We have found Harper Castings uniform, free from porosity and of excellent machining properties."

Harper and **Harper-Meehanite** *Castings*

CASTINGS WITH THE HARPER SKIN

JOHN HARPER & CO. LTD · JOHN HARPER (MEEHANITE) LTD · ALBION WORKS · WILLENHALL

PHONE: WILLENHALL 124 (5 Lines) GRAMS: HARPERS, WILLENHALL

LONDON OFFICE: CHANDOS HOUSE, BUCKINGHAM GATE, LONDON, S.W.1 Telephone: ABBEY 3184

H 253

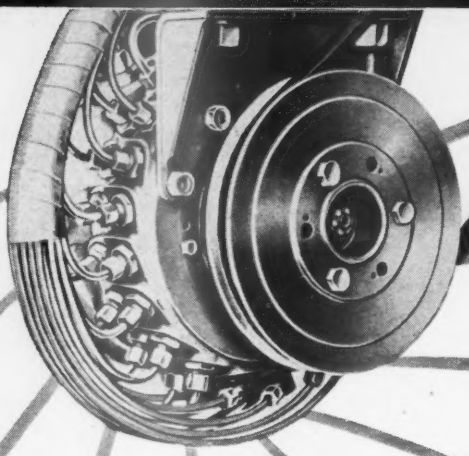
Modern Automatic Lubrication of

BUSES & COMMERCIAL VEHICLES

by means of

'Syndromic

MILEAGE CONTROLLED LUBRICATOR



Fitted to new Public Service Vehicles as standard equipment.

Backed by Tecalemit design and service.

Pre-determined quantities of oil to each point.

Adequate and consistent lubrication ensured throughout.

Eminently suited to fleet conversion.

The outcome of over 20 years experience.

All 40 main points lubricated individually.

Self-lubricated pump requiring no attention.

Oil fed under high pressure

Lubrication carried out on a definite mileage basis.

TECALEMIT

The Authority on Lubrication

BRENTFORD · ENGLAND

LUBRICATION & SERVICING EQUIPMENT

For every Industry

METERING & FILTRATION

T300.

Centre drills

DORMER

THE SHEFFIELD TWIST DRILL AND STEEL COMPANY LTD.

SHEFFIELD · ENGLAND · PHONE: 24137 (5 LINES) · GRAMS: PROELLS · SHEFFIELD

LONDON OFFICE: TERMINAL HOUSE · LOWER BELGRAVE STREET · S.W.1. · PHONE: SLOANE 2111 (4 Lines) · GRAMS: PROELLS KNIGHTS LONDON

Dormer Tools are obtainable from your usual Engineers' Merchant

MAKING SURE ABOUT

friction

AUTOMOBILE ENGINEERS are well aware of the difference between the drawing-board and the road. In their calculations, they allow a margin for use and misuse, overloading and wear. Similarly Ferodo Ltd., throughout their long association with the motor industry, have taken pride in supplying friction linings *more* than equal to the constantly increasing demands of power and speed.

In developing materials for specific needs, Ferodo engineers employ every kind of advance testing: not only on the road, but in the Ferodo Physical Test Laboratory, where special equipment can subject brake or clutch linings and mechanisms to *full-scale* tests of any desired severity, duration, or frequency. Speed and pressure can be precisely controlled, while torque, temperature, and wear are measured and recorded.

All these facilities, and the experience of the technical staff, are freely at your disposal for the solution of particular problems in this field.

FERODO

Brake and Clutch Linings

FEROGRIP

Fan Belts

FERODO LIMITED, CHAPEL-EN-LE-FRITH

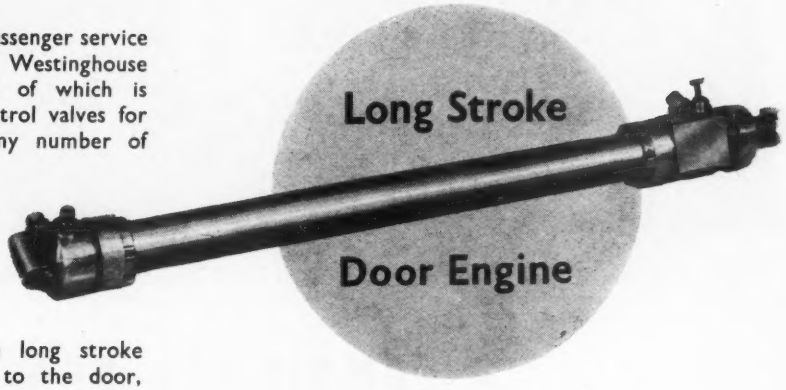
A Member of the Turner & Newall Organization.

REG'D TRADE MARK FERODO

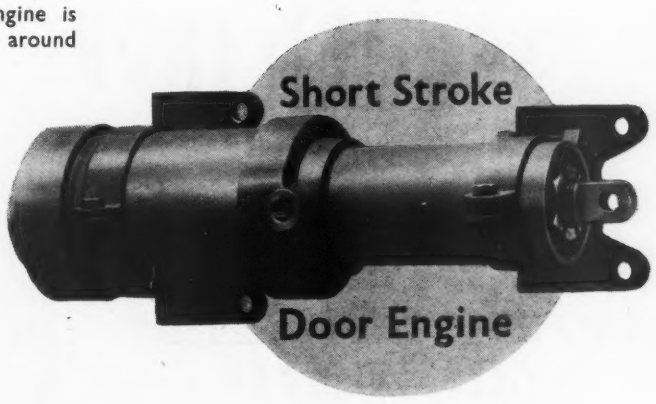
Westinghouse Air-operated Door Gear

for all types of
P.S.V.

Sliding and folding doors as used on passenger service vehicles can now be operated by Westinghouse Air-Operated Door Gear, a range of which is available, comprising engine with control valves for operation by push buttons from any number of control points.



Sliding doors are operated by the long stroke engine which is directly connected to the door, so arranged as to cushion the movement at each end of travel.
For folding doors a short stroke door engine is arranged to operate the door by turning it around the pivot point.



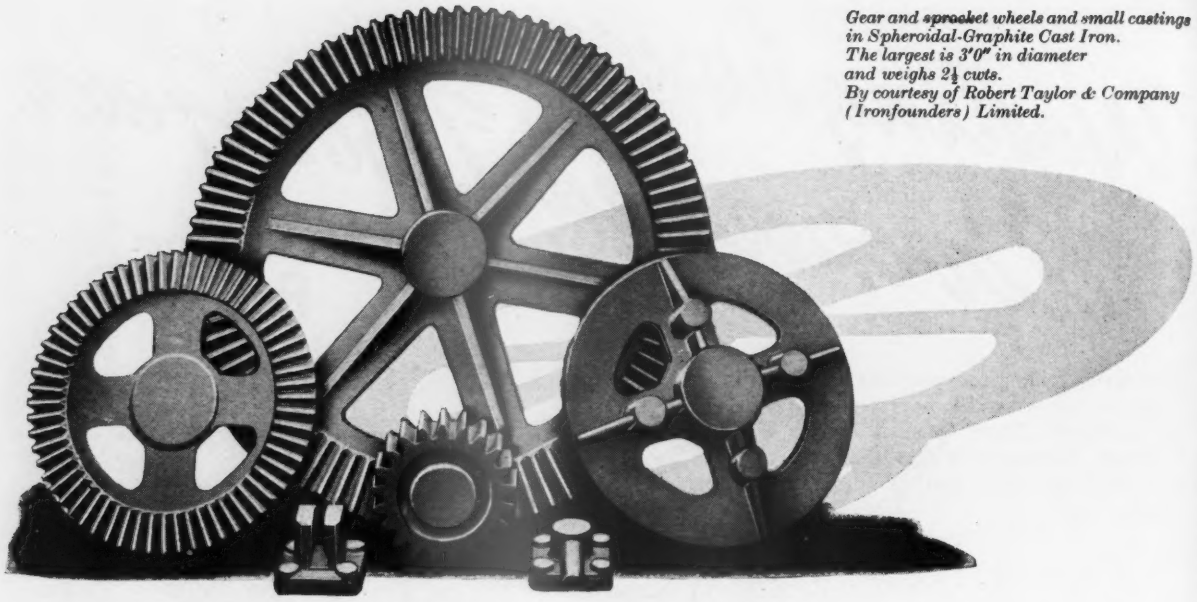
Indicator lamps are supplied to indicate the door positions to the driver.

- *Positive and Smooth movement*
  Combined with
- *Complete safety for passengers*
- *Economical in air consumption*

Write for full particulars to:—

WESTINGHOUSE BRAKE & SIGNAL CO., LTD.
82 YORK WAY, KING'S CROSS, LONDON, N.1

Sales Agents for Road Transport Undertakings:
EQUIPMENT & ENGINEERING CO., LTD., 2-3 Norfolk Street, Strand, London, W.C.2



Gear and sprocket wheels and small castings in Spheroidal-Graphite Cast Iron. The largest is 3'0" in diameter and weighs 2½ cwts. By courtesy of Robert Taylor & Company (Ironfounders) Limited.

A completely new type of CAST IRON

—which, in many ways, behaves more like a steel, is now in commercial production. It is stronger than conventional cast iron and exhibits ductility.

These remarkable properties are the result of a process whereby the graphite flakes, a source of weakness and brittleness in conventional cast irons, are replaced by spheroids.

The new spheroidal-graphite cast irons fall into two main classes, with the following properties :

	Tensile Strength t.s.i.	*Yield Point t.s.i.*	*Elongation %*
HIGH STRENGTH *(pearlitic)*	35-45	25-33	Up to 3
HIGH DUCTILITY *(ferritic)*	30-35	20-25	10-20

Production of the ferritic grade normally requires a short anneal.

The field of application will be wide and will include many applications for which malleable cast iron or carbon steel are at present used.

Licencees. The process is the subject of a number of patents and patent applications and The Mond Nickel Company Limited has granted manufacturing licences to the following firms :

- *W. A. Baker & Company Limited, Newport, Monmouthshire.*
- *Cooper Brothers Limited, Bethesda Street, Burnley, Lancashire.*
- *Fodens Limited, Elworth Works, Sandbach, Cheshire.*
- *Lloyds (Burton) Limited, Wellington Works, Burton-on-Trent.*
- *Sheepbridge Stokes Centrifugal Castings Company Limited, Chesterfield, Derbyshire.*
- *Robert Taylor & Company (Ironfounders) Limited, Larbert, Scotland.*
- *Sir W. G. Armstrong Whitworth & Company (Ironfounders) Limited, Close Works, Gateshead-upon-Tyne.*

MOND NICKEL

THE MOND NICKEL COMPANY LIMITED Sunderland House · Curzon Street · London · W.1

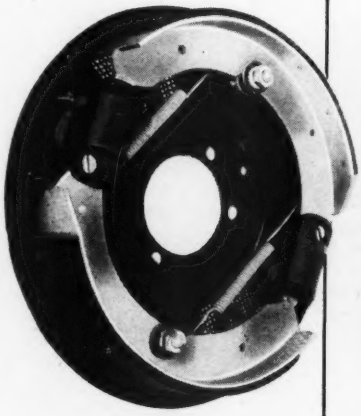
Britain's fastest Saloon car fits the new

GIRLING

THE BEST BRAKES IN THE WORLD

autostatic
TWO TRAILING SHOE
SELF ADJUSTING
HYDRAULIC
BRAKES

REDUCING *BRAKE FADE* TO A MINIMUM



Thomas Wisdom says
"... it is a revolutionary
Braking System
and my verdict is
The Greatest
Technical Development
at the Show"

TOGETHER WITH GIRLING
HEAVY DUTY TELESCOPIC
DAMPERS

GIRLING LIMITED · KINGS ROAD · TYSELEY · BIRMINGHAM 11

WHERE TO GET

ROTOFLO *Pressure Flow* DAMPERS

The ONLY Non-Friction Type that NEEDS NO TOPPING UP!

In a matter of hours your vehicles — wherever they are — can be fitted with Rotoflo — the New Ride Dampers. A country-wide network of Distributors, Authorised Fitting Agents and Garages is organised to give this spot-on service. The following Main Distributors will gladly supply full details.

BIRMINGHAM
Universal Dampers Ltd.,
Cranmore Boulevard,
Shirley.
SHirley 2278

BELFAST
The Northern Ireland
Spring Co.,
Duraflex House,
Donegall Square Mews.
Belfast 28327

BOURNEMOUTH
Rothon Radiators Ltd.,
65 Stewart Road.
Boscombe 37311

BRISTOL
Western Services
(Bristol) Ltd.,
Midland Road, 2.
Bristol 21824

CARDIFF
Bearings (Cardiff) Ltd.,
Ely.
Llandaff 1056

CHELTENHAM
Walker & Ward Ltd.,
Warwick Place.
Cheltenham 3816

COVENTRY
Guyvers (Coventry) Ltd.,
Greyfriars Lane.
Coventry 63224

DUBLIN
John H. Moore Ltd.,
11 Aungier Street.
Dublin 53602

EMSWORTH, HANTS.
Rothon Radiators Ltd.,
1 Sultan Road.
Emsworth 7770

GLASGOW
West of Scotland Eng.
Motor & Welding Co. Ltd.,
131 Houldsworth St., C.3.
CENtral 5776

HINDHEAD
Hindhead Motor Works
Ltd.,
Hindhead, Surrey.
Hindhead 663

HUDDERSFIELD
Hebble Auto Services,
Bradford Road.
Huddersfield 5840

HULL
Crystal Motor, General &
Elec. Eng. Co. Ltd.,
Bank Street.
Hull 15680

KING S LYNN
Motorists' Specialities
(King's Lynn).
King's Lynn 2422

LANCASTER
Frank Hopwood Ltd.,
83 Market Street.
Lancaster 177

LEICESTER
Castle's Unit Development
Ltd.,
Church Gate.
Leicester 65251

LIVERPOOL
District Auto Services Ltd.,
7 Little Catherine Street,
Liverpool, 8.
ROYal 2029

Frank Hopwood Ltd.,
3 Rialto Buildings,
Upper Parliament Street.
ROYal 2384

LLANDUDNO
Hutchinson & Wilde Ltd.,
Reliance Garage,
Nant-y-Gamar Road.
Llandudno 6542

LONDON (NORTH)
Broadfields Garage & Eng.
Co.,
Standard House,
Cockfosters.
Barnet 7301

LONDON (SOUTH)
Robin Hood Garage
(Anerley) Ltd.,
97/99 Croydon Road,
Anerley.
Sydenham 7066

LONDON (EAST)
Shock Absorber Service,
125 Lower Clapton Road,
Clapton, E.5.
Amherst 6468

LONDON (WEST)
Shock Absorber Service,
364 Uxbridge Road,
Shepherd's Bush, W.12.
Shepherd's Bush 4251

MANCHESTER
Frank Hopwood Ltd.,
Midway Garage,
Matthews Lane,
Longsight, 12.
Rusholme 5507

NEWCASTLE
Andrew A. Barton,
The Garage, Newburn,
Newcastle-on-Tyne.
Lemington 74449

NORTHAMPTON
A. Mulliner Ltd.,
Bridge Street.
Northampton 907

NOTTINGHAM
Frank Hopwood Ltd.,
Summer Street
(Near Midland Station).
Nottingham 88472

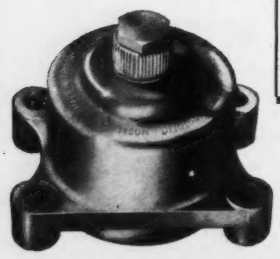
SHEFFIELD
Brooklands Garage,
Brooklands Avenue,
Fulwood, 10.
Sheffield 31411

STOKE-ON-TRENT
Trent Vale Motors,
Harshill Road, Hartshill.
Newcastle (Staffs.) 69688

SUDBURY
Atkins Fulford Ltd.,
Sudbury, Suffolk.
Sudbury 2335

THUNDERSLEY
Atkins Fulford Ltd.,
9 Parkfield Parade,
Thundersley, Essex.
Hadleigh 58763

WOLVERHAMPTON
Wolverhampton Motor
Services Ltd.,
Cleveland Road.
Wolverhampton 20894

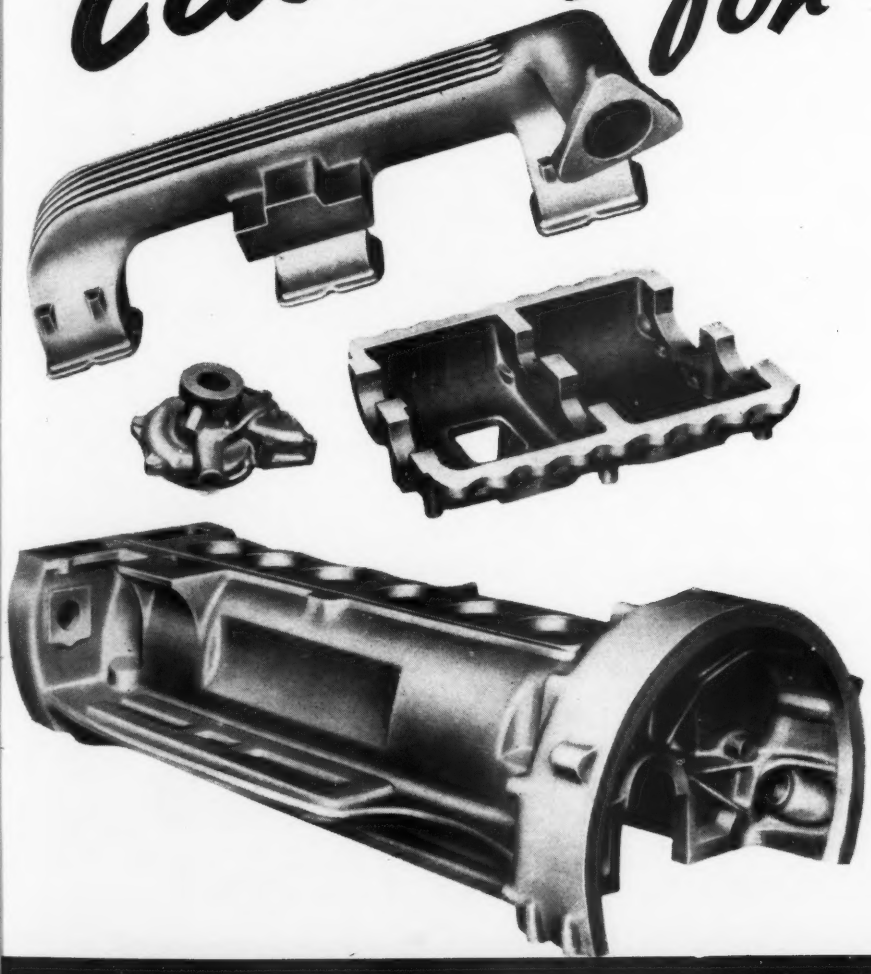


MODEL G3
There is a Rotoflo model for almost every make of light or heavy commercial vehicle and for loads up to 2 tons per wheel.

Fleet Owners, Public Transport Authorities, and motorists by the thousand are replacing with Rotoflo. Road shocks effectively cushioned, wear on suspension components minimised and topping-up eliminated—these are a few of the Rotoflo advantages. Benefit by them yourself! Write now to your nearest Main Distributor for address of your local Fitting Agent.

1565

Castings for Leyland



Every component part used in the production of Leyland Motors must conform to the very exacting standards of quality and durability laid down by the manufacturers of these world renowned vehicles.

The castings made for Leyland Motors Ltd. by West Yorkshire Foundries are laboratory controlled and subject to the most rigid inspection at all stages of production in order to fulfil these requirements.

Castings are supplied in high duty iron and in aluminium alloys by the sand and gravity die processes. Technical literature specification sheets, etc., are available on request.

B

WEST YORKSHIRE FOUNDRIES LTD

SAYNER LANE · LEEDS 10 · Tel: 29466-7-8

STOP

to consider the many advantages gained by using CAPASCO Heavy Duty Non-Fade Moulded BRAKE LININGS. Test will prove that the characteristics claimed are confirmed in Practice.

LOOK at this selection from the full range.

LISTEN to the opinions expressed by the steadily increasing number of Chassis Manufacturers and Fleet Operators who specify exclusively —

CAPASCO

NON-FADE *Moulded* BRAKE LININGS

THE CAPE ASBESTOS CO LTD

114 – 116 PARK . STREET · LONDON W.1

Phone : GROSVENOR 6022 P.B.X. Grams : "INCORRUPT, LONDON"

MACHINE TOOL IMPORTS FROM SWITZERLAND & W. GERMANY

● OPEN GENERAL LICENCE ISSUED NOW

THE FOLLOWING MAY BE OBTAINED WITHOUT IMPORT LICENCE

● FROM SWITZERLAND

(Sole Agents in Great Britain: BURTON, GRIFFITHS & CO. LTD.)

MAAG—GEAR GENERATORS, Capacity 2″ to 16′ diameter.

MAAG—GEAR GRINDERS, Capacities 1″ to 140″ diameter.

MAAG—GEAR TESTING INSTRUMENTS.

● FROM WESTERN GERMANY

Sole Agents: LEO. C. STEINLE LTD.

BECHE AND GROHS—HAMMERS, Pneumatic and Steam. ROLLING MACHINES, Retaining Ring.

BERNINGHAUS—BAR COIL FEED AUTOMATIC FORMING MACHINES, Capacities, Round—$\frac{5}{32}$″—$\frac{35}{64}$″.

BOLEY—FINE TURNING LATHES, BENCH LATHES, DRILLING AND TAPPING MACHINES, (Multi-Spindle).

GOECKEL—BLADE and CUTTER GRINDERS, for Wood and Allied Trades.

HEYLIGENSTAEDT—CENTRE LATHES, SURFACING LATHES, COPYING LATHES, COPYING ATTACHMENTS, VERTICAL COPYING MILLS.

HULLER—BORING AND MILLING MACHINES AND UNITS. TAPPING MACHINES, DEEPHOLE DRILLING MACHINES.

KOSFELD—AUTOMATIC NUT TAPPING AND COUNTERSINKING MACHINES.

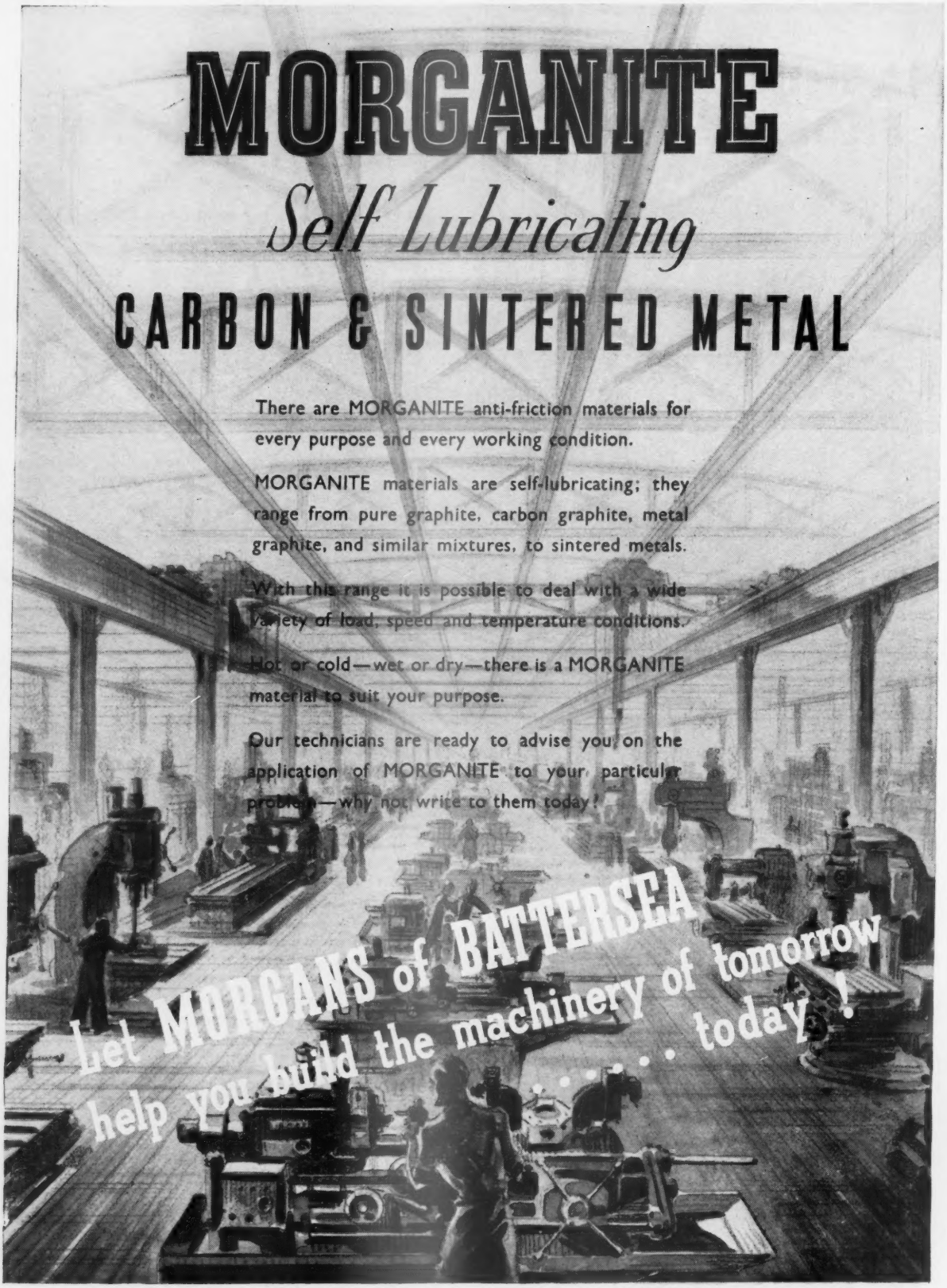
LUDWIGSBURGER—FINE BORING MACHINES AND EQUIPMENT.

● *DISTRIBUTORS:*

BURTON, GRIFFITHS & CO. LTD. MARSTON GREEN BIRMINGHAM

AND BRANCHES

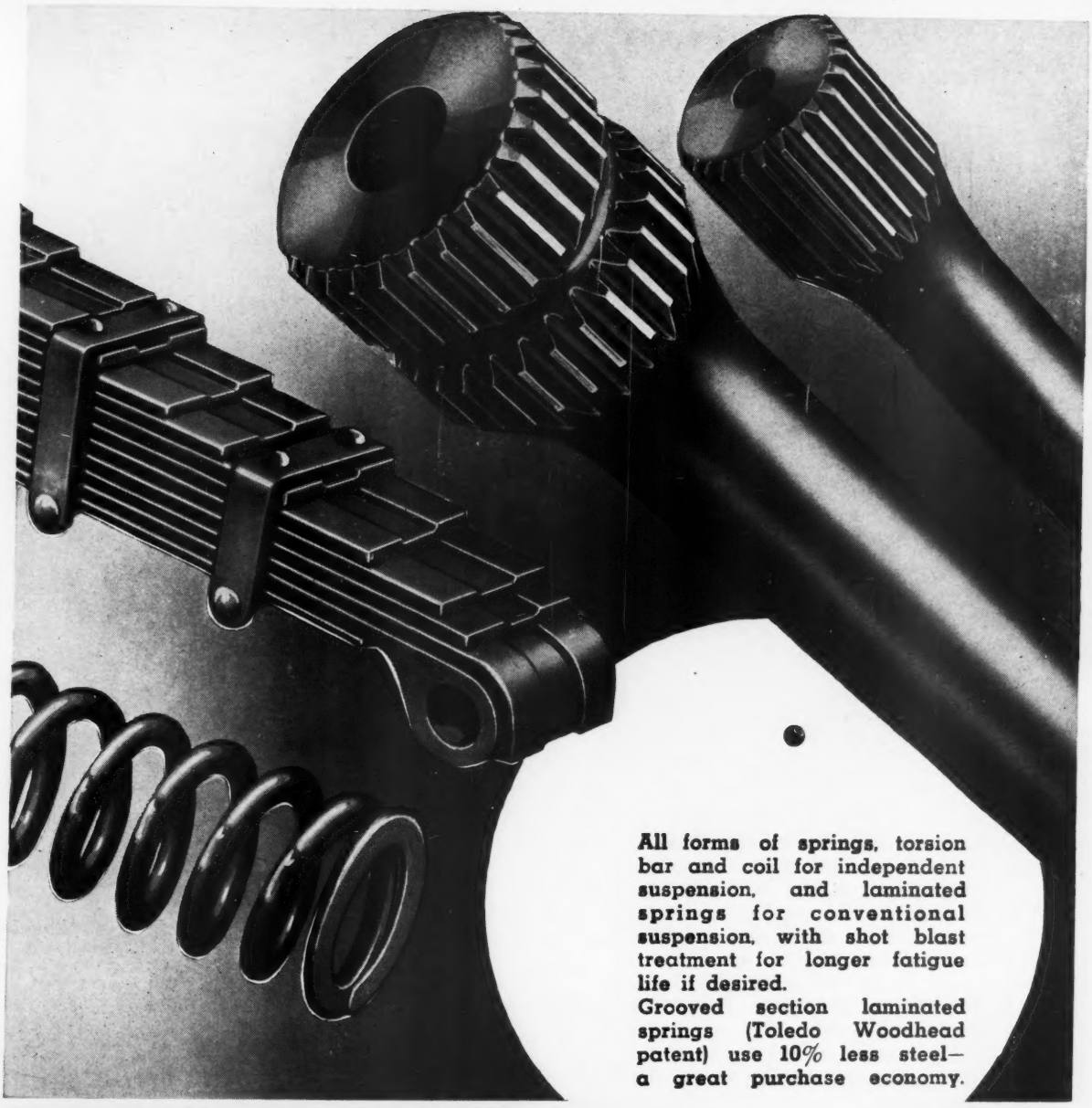
TELEPHONES: *BIRMINGHAM,* **STECHFORD 3071** *LONDON,* **RELIANCE 3891**


MORGANITE
Self Lubricating
CARBON & SINTERED METAL
There are MORGANITE anti-friction materials for every purpose and every working condition.
MORGANITE materials are self-lubricating; they range from pure graphite, carbon graphite, metal graphite, and similar mixtures, to sintered metals.
With this range it is possible to deal with a wide variety of load, speed and temperature conditions.
Hot or cold—wet or dry—there is a MORGANITE material to suit your purpose.
Our technicians are ready to advise you on the application of MORGANITE to your particular problem—why not write to them today!
Let MORGANS of BATTERSEA help you build the machinery of tomorrow . . . . today!

THE MORGAN CRUCIBLE COMPANY LIMITED · BATTERSEA CHURCH ROAD · LONDON S.W.11

TELEPHONE: BATTERSEA 8822 · TELEGRAMS: CRUCIBLE SOUPHONE LONDON

C14



All forms of springs, torsion bar and coil for independent suspension, and laminated springs for conventional suspension, with shot blast treatment for longer fatigue life if desired.
Grooved section laminated springs (Toledo Woodhead patent) use 10% less steel—a great purchase economy.

TOLEDO WOODHEAD

SHEFFIELD·3

TWS 16

He's fifteen times the man...

WITH A

Black & Decker

ELECTRIC BENCH GRINDER

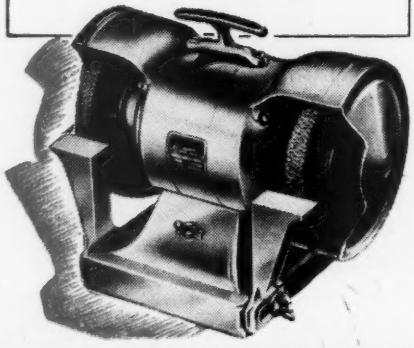
For every minute he spends at the B & D Bench Grinder he used to spend fifteen with hand tools! Research Engineers timed him . . . sharpening tools, smoothing and shaping metal stock . . . cleaning up castings, removing rust and corrosion with the wire wheel brush! This superb machine, with its smooth, powerful action, leaves him valuable time for other jobs. Sizes: 6 in., 7 in., 8 in. and 10 in. with various mountings.

Leading Distributors everywhere sell the world's largest range of

DRILLS · SANDERS · GRINDERS · SCREWDRIVERS

VALVE REFACERS & RESEATING EQUIPMENT &

ELECTRIC BENCH GRINDERS



The first choice of craftsmen the world over

BLACK & DECKER LIMITED DEPT. N5 HARMONDSWORTH MIDDLESEX

Phone: West Drayton 2681/7 Grams: Blacdeck, West Drayton

LONDON · BIRMINGHAM · BRISTOL · GLASGOW · LEEDS · MANCHESTER · NEWCASTLE · NOTTINGHAM

Smee's

Detachable oil filter

element easily inspected and replaced

This new AC partial-flow oil filter with replaceable element meets the increasing demand for a filter that can be removed for inspection and replaced every 8/10,000 miles. It provides a permanent installation for coupling into a by-pass oil supply system and the filtering element can be replaced without disturbing pipe connections. Sump oil is filtered on an average of ten times an hour. This means less motor wear and longer motor life — the objective of every motor manufacturer.

AC

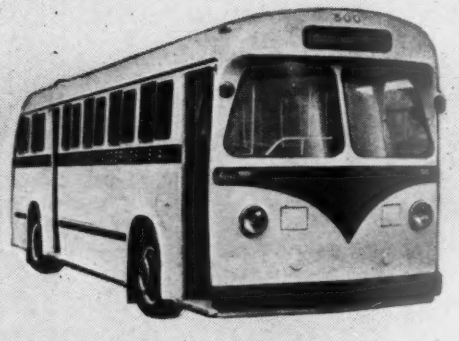
AIR CLEANERS · AIR SILENCERS · CRANKCASE BREATHERS
CAR HEATERS · FUEL PUMPS · SPEEDOMETERS · GAUGES
INSTRUMENT PANELS · OIL FILTERS · THERMOSTATS
SPARK PLUGS · WINDSCREEN WIPERS · DIE CASTING

If you are contemplating an important new design, or a modification of an existing one, take advantage of the facilities of the AC Technical Bureau. We probably can save you hours of planning and experimentation. Write to the AC Technical Bureau, 54, The Butts, Coventry; or telephone Coventry 61747

AC-SPHINX SPARK PLUG COMPANY,
DIVISION OF GENERAL MOTORS LTD.,
DUNSTABLE, BEDFORDSHIRE

Looking like ten million dollars

It would be almost worthwhile to take a trip to Cuba just to have a ride in buses as magnificent as these. But the most attractive thing about them is what they mean in Dollars for Britain. The complete order was for 620 buses to a total value of over 10,000,000 dollars. The chassis are Leyland Royal Tigers with under floor engines. The 'Rivaloy' bodies are made by Saunders Engineering and Shipyard Ltd. What won't be seen by the passengers are the large quantities of T.I. Aluminium Tubing and Extrusions which were used in the construction of the body frames.



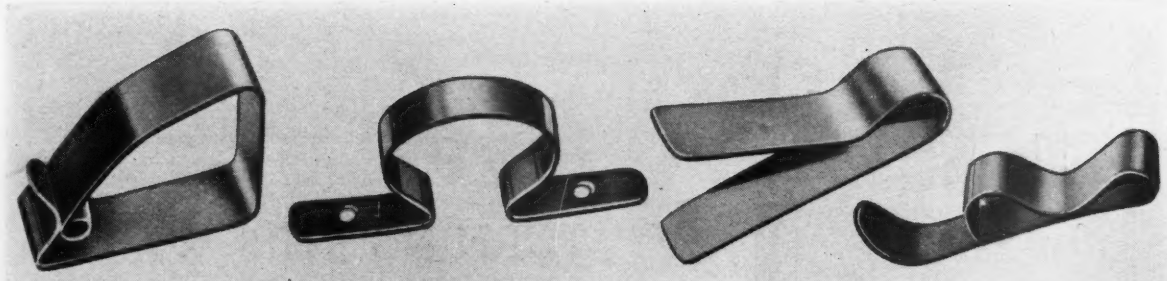
FOR JOBS LIKE THIS . . .

PUT Aluminium FIRST AND TI IN FRONT OF IT

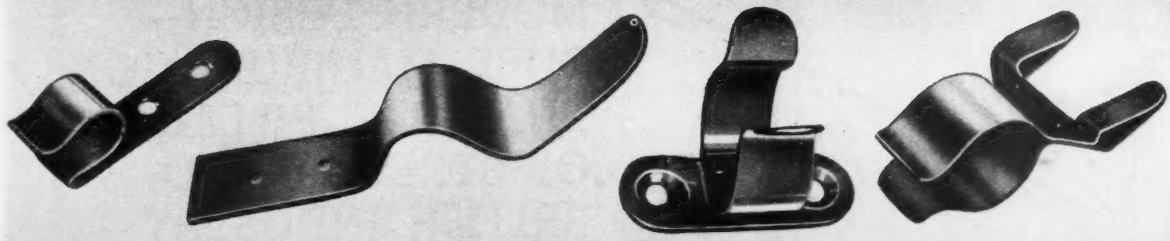
ALUMINIUM AND ALUMINIUM ALLOY INGOT, SLABS, BILLETS, SHEET, STRIP, TUBES AND EXTRUSIONS TO ALL COMMERCIAL, A.I.D. AND LLOYD'S SPECIFICATIONS.

A TI COMPANY

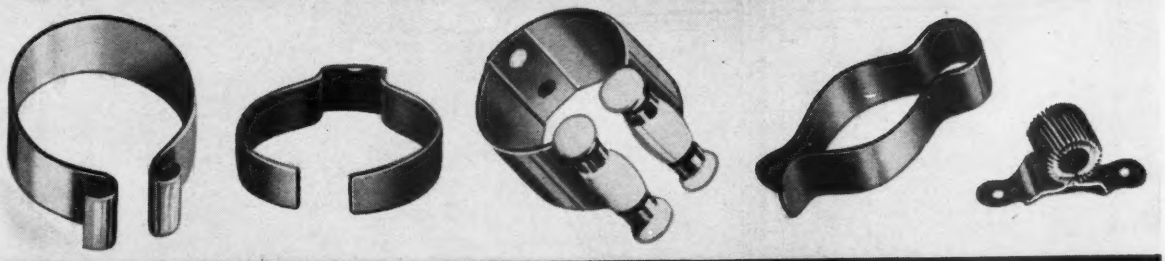
T.I. ALUMINIUM LTD., REDFERN ROAD, TYSELEY, BIRMINGHAM. Tel: Acocks Green 3333



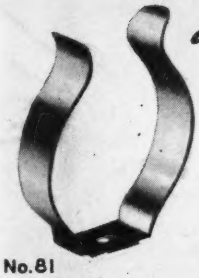
THAT CLIP YOU NEED



IS MADE BY



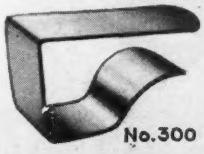
TERRY'S (the Spring people)



No.81

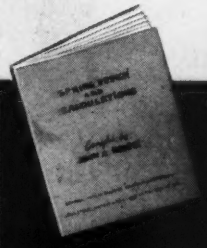
and 3 Special Clips

Two very popular types, 80 and 81. In a range of sizes from ½" to 2" from stock. No. 300 is a very popular drawing board clip with a host of additional uses. 5/- a doz. (incl. P.T.) from stock.



No.300

No.80

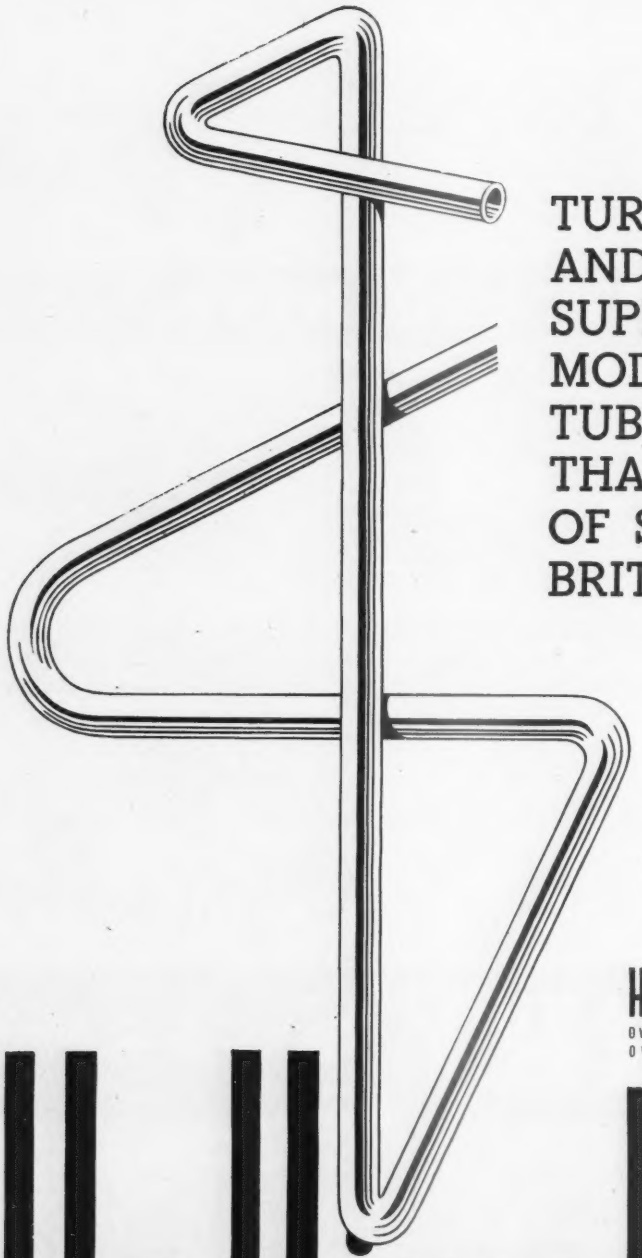


WANT TO KNOW ALL ABOUT SPRINGS? HERE IS **THE** MANUAL — 10/6 POST FREE.

Clips in every shape, size and form . . . steel clips, bronze clips, stainless clips, little clips, big clips, clips made exactly as you want them. If you desire it we can design any kind of clip to your own exact specification. (*We've been designing clips for 95 years!*)

Sole Makers:
HERBERT TERRY & SONS LTD.,
REDDITCH
London Birmingham Manchester

H.T.I.D.



TURNING THIS WAY
AND THAT WAY IN
SUPPORT OF
MODERN DESIGN—
TUBE MANIPULATIONS
THAT ARE PILLARS
OF STRENGTH TO
BRITISH INDUSTRY

Helliwells Ltd
OVER HALF A CENTURY OF KEEPING FAITH
OVER FIFTY YEARS OF PROGRESS

Helliweld

ELECTRICALLY WELDED
TUBE

from 5/8" – 2"
from 16 – 20 gauge

Head Office : THE AIRPORT • WALSALL • STAFFS • *England* Dept. T.I.
Works : TREFOREST TRADING ESTATE • PONTYPRIDD • GLAMORGANSHIRE • *South Wales*

Morrisflex

A New Policy

B. O. MORRIS LIMITED are proud to announce a progressive scheme, carefully planned to give speedier service and supply of Morrisflex Equipment to the Motor Trade.

Morrisflex Motor Trade Distributors have recently been appointed throughout the country, and comprehensive supplies of Morrisflex Equipment are now available in your locality.

Your continued and valued support through your local Factor or Distributor will receive expert attention by Morrisflex - trained personnel.

Distributors already appointed include :—

Anco (Potteries) Ltd.,
Copeland Street,
Stoke-on-Trent.

Ashford Motor Factors,
15, Wellesley Road,
Ashford,
Kent.

Associated Automotive Supplies Ltd.,
Buttermarket Street,
Warrington.

Auto Factors Ltd.,
9 and 10 Summerland Place,
Plymouth.

Brown Bros. Ltd.,
Great Eastern Street,
London, E.C.2.

A. Crabtree & Co. Ltd.,
Cavendish Street,
Keighley.

Percy Deans & Son Ltd.,
2 and 4 Cross Belgrave Street,
Leeds, 2.

East of Scotland Factors Ltd.,
31, High Street,
Dundee.

Ewen Ltd.,
47, Winchester Street,
Salisbury.

Globe Electric Co. Ltd.,
194-6 Canal Street,
Nottingham.

Haslam & Stretton Ltd.,
227, Stapleton Road,
Bristol, 5.

Hurden's Ltd.,
22, St. Helen's Road,
Swansea.

E. Le Couteur Ltd.,
58-59, Snow Hill,
Birmingham, 4.

McFadden & Barron Ltd.,
5, Slater Street,
Liverpool, 1.

Fred Medcalf & Co. Ltd.,
6a-6b, Maidenburgh Street,
Colchester.

Ernest Moore & Son Ltd.,
Old Town Hall,
Nantwich,
Cheshire.

Motor Supplies (Bolton) Ltd.,
210a, St. George's Road,
Bolton, Lancs.

J. Nicholson & Co., (Factors) Ltd.,
Kensington Place,
Bolton, Lancs.

Penge & Bognor (Wholesale) Ltd.,
Richmond Road,
Bognor Regis.

South Coast Vulcanising Co.,
Denmark Villas,
Hove.

Spare Parts Ltd.,
St. Peter Street,
Blackburn.

Leo Swain & Co. Ltd.,
Autofax House,
St. John Street, Deansgate,
Manchester, 3.

Thomson & Brown Bros. Ltd.,
126, George Street,
Edinburgh, 2.

Tom Wallace (Liverpool) Ltd.,
Hope Street,
Liverpool, 1.

West & Sellick Ltd.,
230, Hatfield Road,
St. Albans, Herts.

Yorkshire Factoring Co. Ltd.,
72, Park Lane,
Leeds.

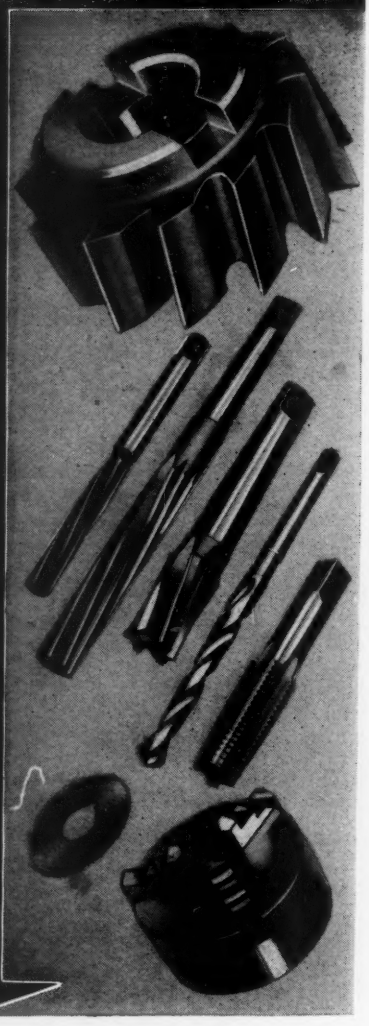
THE WORLD'S FINEST FLEXIBLE SHAFT EQUIPMENT

B. O. MORRIS LTD . MORRISFLEX WORKS . BRITON ROAD . COVENTRY

Telephone Coventry 5081/2/3

EX STOCK DELIVERIES OF REGULAR LINES

TWIST DRILLS
MILLING CUTTERS
REAMERS
SOCKET SCREWS
TAPS AND DIES
SLITTING SAWS
SIDE CHIP SAWS
SANDING DISCS
HACK SAW BLADES
TOOL BITS
LATHE TOOLS
- - FILES - -
SLEEVES AND SOCKETS
ADJUSTABLE REAMERS
LATHE CHUCKS
BROACHES
DIE STOCKS
DRILL CHUCKS
MACHINE VICES
REVOLVING CENTRES



STOCKISTS of "DORMER", "E.S.C.—V.A.P.", "CARDINAL", "QUALCUT", "DOUBLE-MUSHET", "GOLDEN ARROW", "SPEEDICUT", "CAPITOL", "WARRIOR, "WHIRLWIND", "UNBRAKO", "ARCHER", "JACOB", "ECLIPSE", "DING DONG", "TOLEDO", Etc.

MONKS & CRANE LTD

THE TWIST DRILL SPECIALISTS

Head Office: STANHOPE STREET, BIRMINGHAM 12

Phone: CALTHORPE 3177 (3 lines). *Grams: EMANCEE, BIRMINGHAM.*

London Office: 295 EUSTON ROAD, LONDON, N.W.1.

Phone: EUSTON 5311 (3 lines). *Grams: EMANCEE, LONDON.*

Push button control

on the

NEW

TRIUMPH ROADSTER

The new Triumph Roadster, seen recently at Paris and Earls Court, uses Wilmot Breeden Hydraulic Electric equipment for the push button operation of HOOD, WINDOWS, SEAT & HEAD LAMP SHUTTERS. Here is comfort and effortless control with equipment of proved reliability

WILMOT WB BREEDEN LTD

BIRMINGHAM LONDON BRISTOL MANCHESTER GLASGOW

TRANSMISSION
COMPONENTS
for commercial and passenger vehicles
DAVID BROWN
DAVID BROWN
& SONS (HUDDERSFIELD) LIMITED
HUDDERSFIELD ENGLAND

OWEN GROUP COMPONENTS

Travel the world with British Vehicles

MANUFACTURERS to the MOTOR TRADE

RUBERY, OWEN & CO.LTD., DARLASTON, SOUTH STAFFS.

Chassis frames (Commerical and Public Transport Vehicles. Cars and Caravans).

Axle casings. Light and Heavy Duty.

Car wheels and discs.

Petrol tanks (Cars and Commercial Vehicles).

Caravan and trailer axles.

Valve covers, sumps, brake drums and all types of Deep drawn automotive Pressings.

Bolts, nuts, studs and all bar products.

RUBERY, OWEN & CO. LTD., BRITANNIA WORKS, PAYNES LANE, COVENTRY.

Medium automotive pressings of all types.

RUBERY, OWEN & CO. LTD., WHITEGATE FACTORY, WREXHAM, NORTH WALES.

Stores organisation metal equipment, shelving, racks, bins, lockers, etc.

RUBERY, OWEN (WARRINGTON) LTD., CLEVELEYS ROAD, WARRINGTON.

Front and rear axle assemblies.
Sole British manufacturers of the "Eaton" two-speed rear axle.

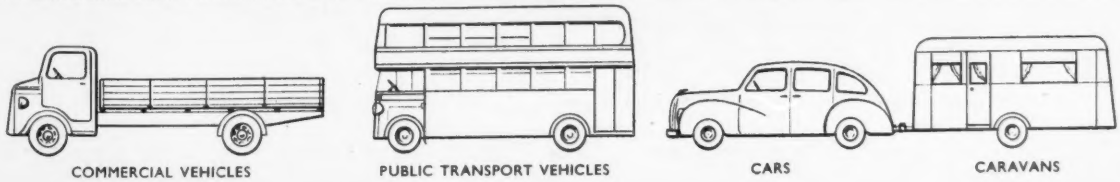
MOTOR PANELS (COVENTRY) LTD., HOLBROOK LANE, COVENTRY.

Car bodies, panels and wings.

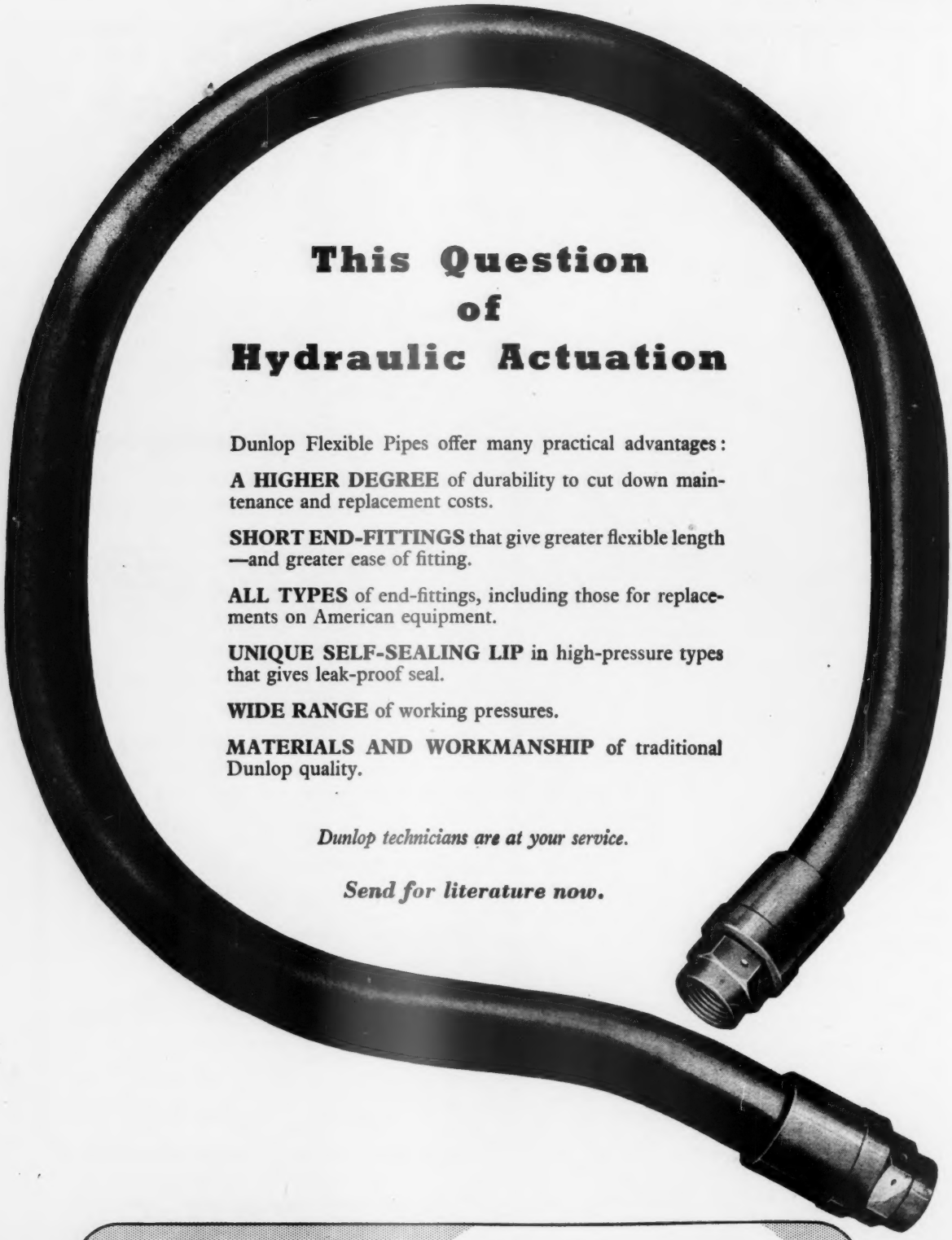
Commercial vehicle cab bodies.

RUBERY, OWEN & KEMSLEY PTY. LTD., FINSBURY, SOUTH AUSTRALIA.

Automotive wheels, frames, axle casings and pressings.



COMMERCIAL VEHICLES | PUBLIC TRANSPORT VEHICLES | CARS | CARAVANS



This Question of Hydraulic Actuation

Dunlop Flexible Pipes offer many practical advantages:

A HIGHER DEGREE of durability to cut down maintenance and replacement costs.

SHORT END-FITTINGS that give greater flexible length —and greater ease of fitting.

ALL TYPES of end-fittings, including those for replacements on American equipment.

UNIQUE SELF-SEALING LIP in high-pressure types that gives leak-proof seal.

WIDE RANGE of working pressures.

MATERIALS AND WORKMANSHIP of traditional Dunlop quality.

Dunlop technicians are at your service.

Send for literature now.

DUNLOP FLEXIBLE PIPES

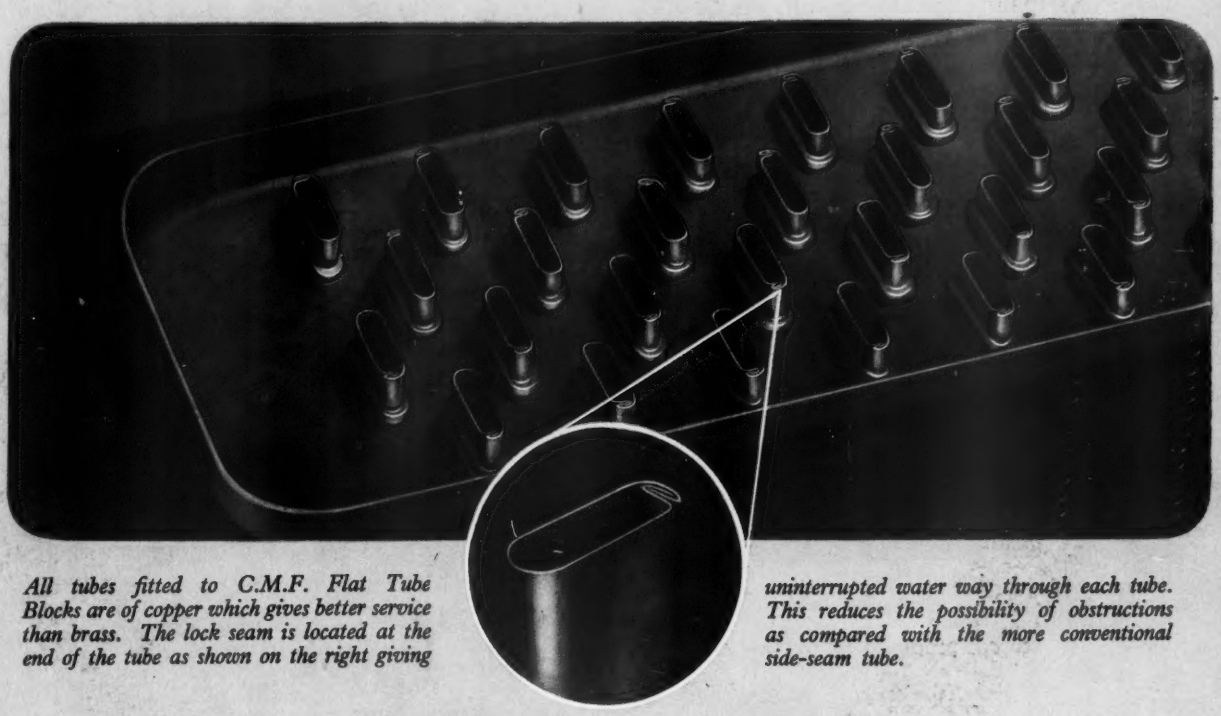
DUNLOP RUBBER COMPANY LIMITED, FOLESHILL, COVENTRY

9H/912

COVENTRY MOTOR FITTINGS

EST'D CMF 1902

LEADING SPECIALISTS IN RADIATOR DESIGN



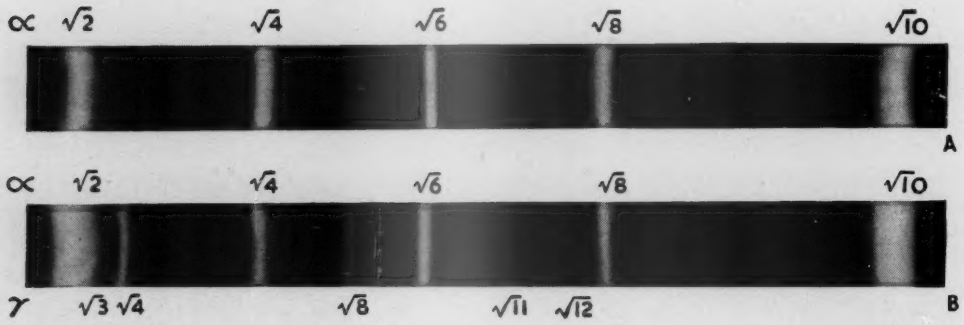
All tubes fitted to C.M.F. Flat Tube Blocks are of copper which gives better service than brass. The lock seam is located at the end of the tube as shown on the right giving uninterrupted water way through each tube. This reduces the possibility of obstructions as compared with the more conventional side-seam tube.

C.M.F. have attained their present leading position as radiator specialists over many years of research and development and today offer a radiator design service with unrivalled experience of every automobile cooling problem. This wide knowledge is supported by the most up-to-date large scale production facilities which are now, and have been for many years, supplying radiators to leading makers of cars, commercial vehicles, stationary sets and mechanical handling plant. Why not let C.M.F. design your next radiator?

COVENTRY MOTOR FITTINGS CO. LTD., COVENTRY. Tel. Cov. 3144-5-6

The three illustrations below show typical production equipment in our Coventry factory which ensure the maintained precision and quality of C.M.F. Radiator Blocks—during high speed low cost production.

Fuel pump cams subjected to X-Ray diffraction tests



High performance depends more than ever before on the scientific control of processes and materials, based on the intensive research work of the metallurgist. Examination of metals and other crystalline materials for structure and texture by X-ray diffraction is one of the modern research methods employed in the C.A.V. laboratories at Acton. In these tests the photographic records produced by the rays show a series of lines, the spacing and relative intensity of which combine to give an accurate indication of the arrangement of atoms and crystals of the material. The two examples reproduced above are of hardened steel, as used for C.A.V. pump cams.

Research of this nature guarantees the high quality and performance of C.A.V. products.

"A" *shows the record of steel, used for C.A.V. pump cams, properly heat treated.*

"B" *shows the same steel, incorrectly heat treated. This is revealed by the presence of extra lines in the pattern which are caused by the retained austenite or gamma phase.*

Fuel Injection and Electrical Equipment

C.A.V. LIMITED, ACTON, LONDON, W.3

174-334

OAKENCORK
and
OAKENSTRONG

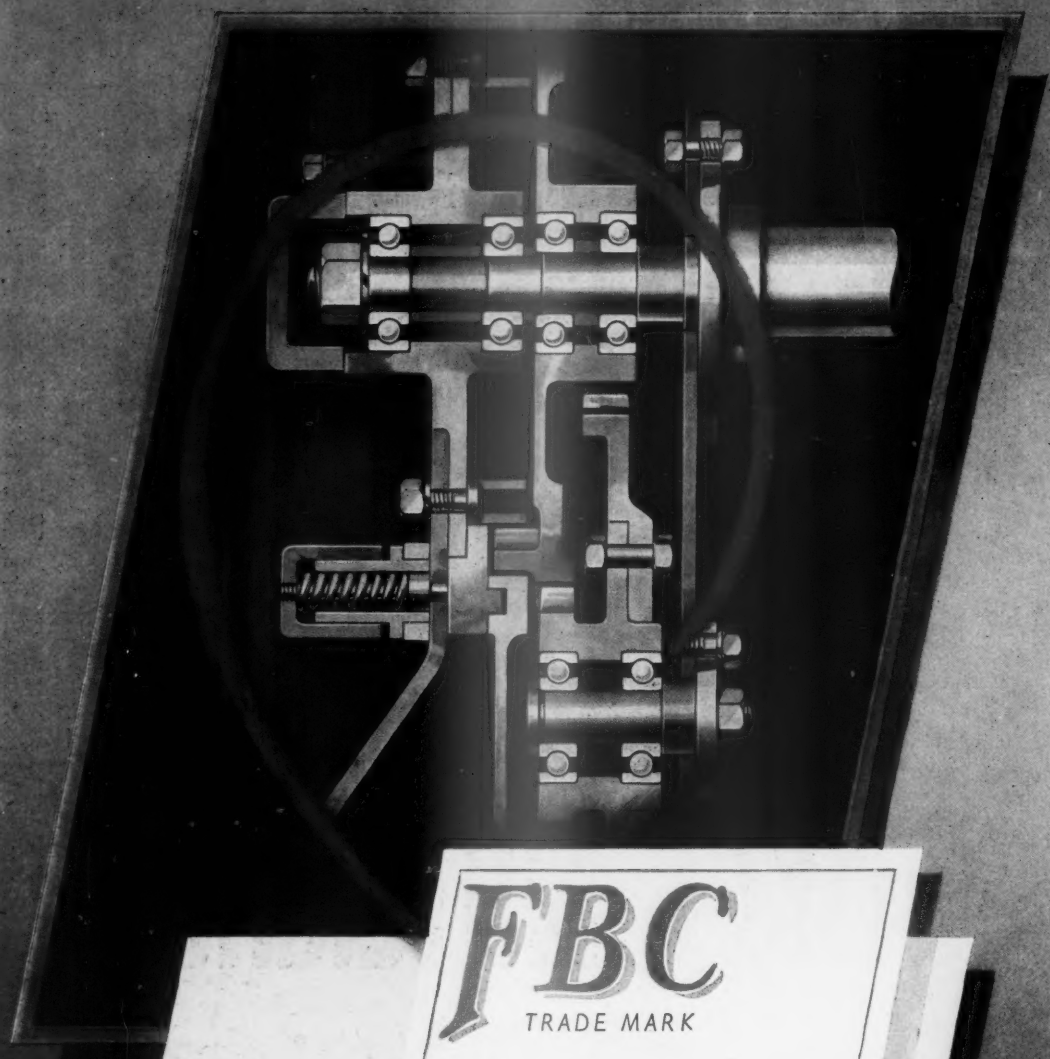
Oil and Petrol GASKET MATERIALS

Foreign & Colonial enquiries to

H. JACKSON LTD. OAKENCLOUGH GARSTANG *NR.* **PRESTON**

Distributors of materials in bulk for Gt Britain

J. A. NORDBERG LIMITED 171. QUEEN VICTORIA ST. E.C.4.



FBC

TRADE MARK

All-British ball and parallel-roller bearings for every purpose.

The illustration shows some of the F.B.C. deep-groove bearings on a gang mower made by Thomas Green & Son, Ltd.

FISCHER BEARINGS CO. LTD., WOLVERHAMPTON

Subsidiary of British Timken Ltd.

Works: Birmingham, and Duston Northampton

ABSOLUTE UNIFORMITY

HAGCO " Silmocrom " and " Austenitic " Cylinder Liners are the finest that metallurgical research can devise or modern precision methods produce—and rigid inspection at every stage permits of no deviation from the uniformly high standards insisted on. The result ? Invariably more efficient lubrication, and cylinder life well beyond the normal span.

HAGCO
Cylinder
LINERS

Stellited Valve Seatings

HAROLD ANDREWS GRINDING COMPANY LIMITED
Bristol Road, Bournbrook, Birmingham, 29. *'Phones : SELly Oak 1128-9-0*
and at Manor Works, Manor Lane, Halesowen. *'Phone: HALesowen 1181-2*

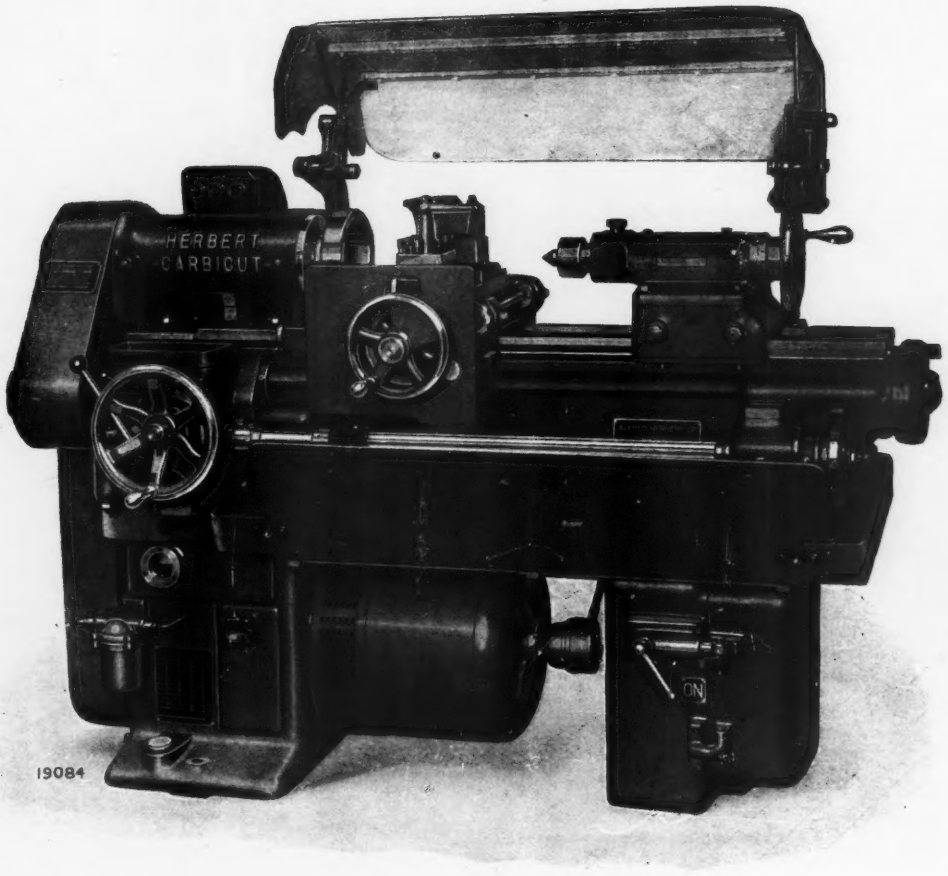
HIGH QUALITY STEELS FOR AUTOMOBILE ENGINEERING

Ask for Brochure No. 463c.

HADFIELDS
SHEFFIELD

HADFIELDS LTD., EAST HECLA WORKS, SHEFFIELD, ENGLAND

HERBERT



HERBERT CARBICUT LATHE

FOR turning and facing shafts and spindles up to $3\frac{1}{4}$" dia. × 23" long at very high speeds up to 3025 R.P.M. using carbide tools.

High production to close tolerances, saving time both in turning and subsequent grinding.

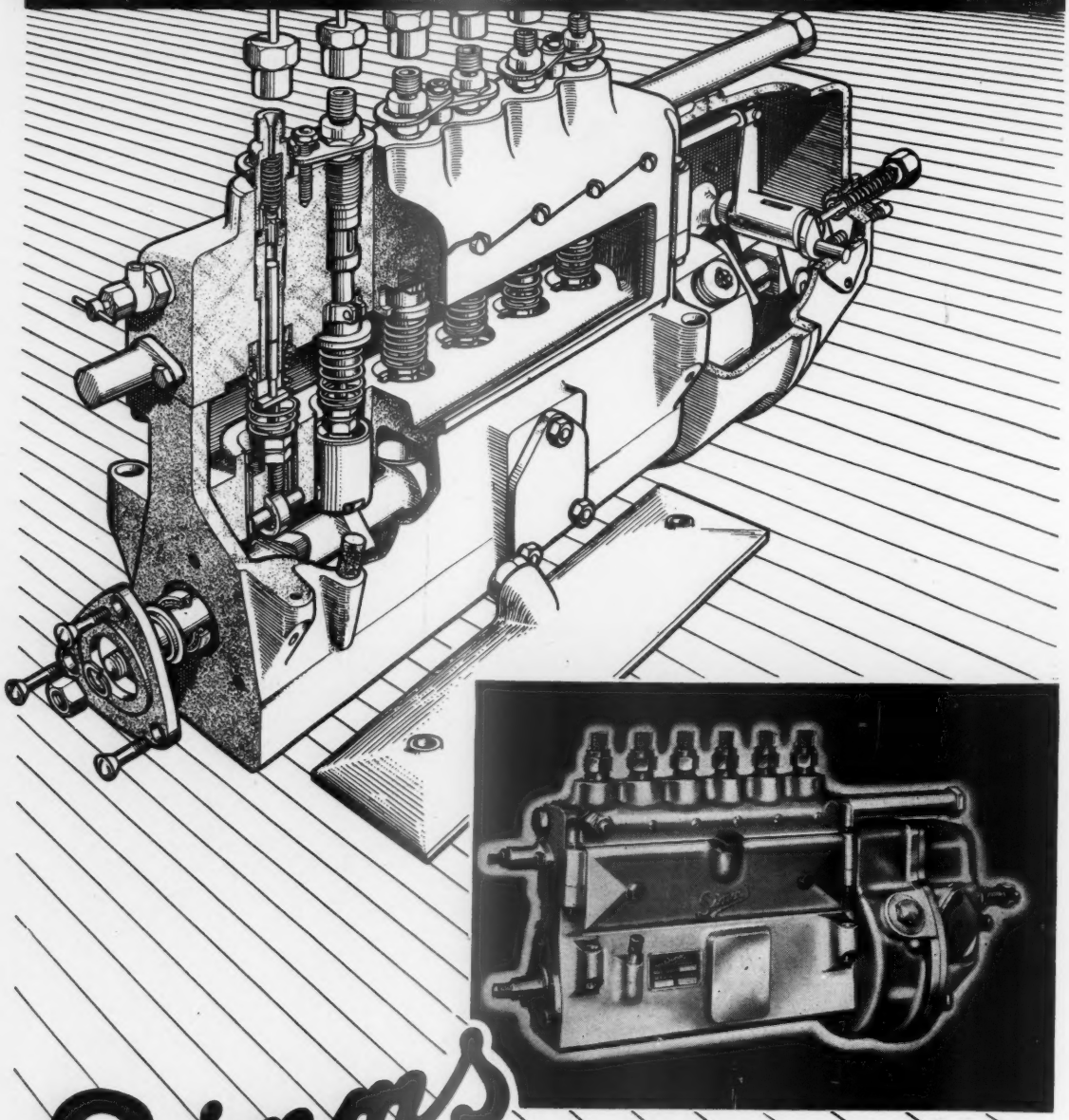
May be seen in operation at our Works.

DELIVERY IN 4 WEEKS

CATALOGUE ON REQUEST

ALFRED HERBERT LTD · COVENTRY

INSIDE INFORMATION.



Simms

Fuel Injection Equipment

SIMMS MOTOR UNITS LTD.

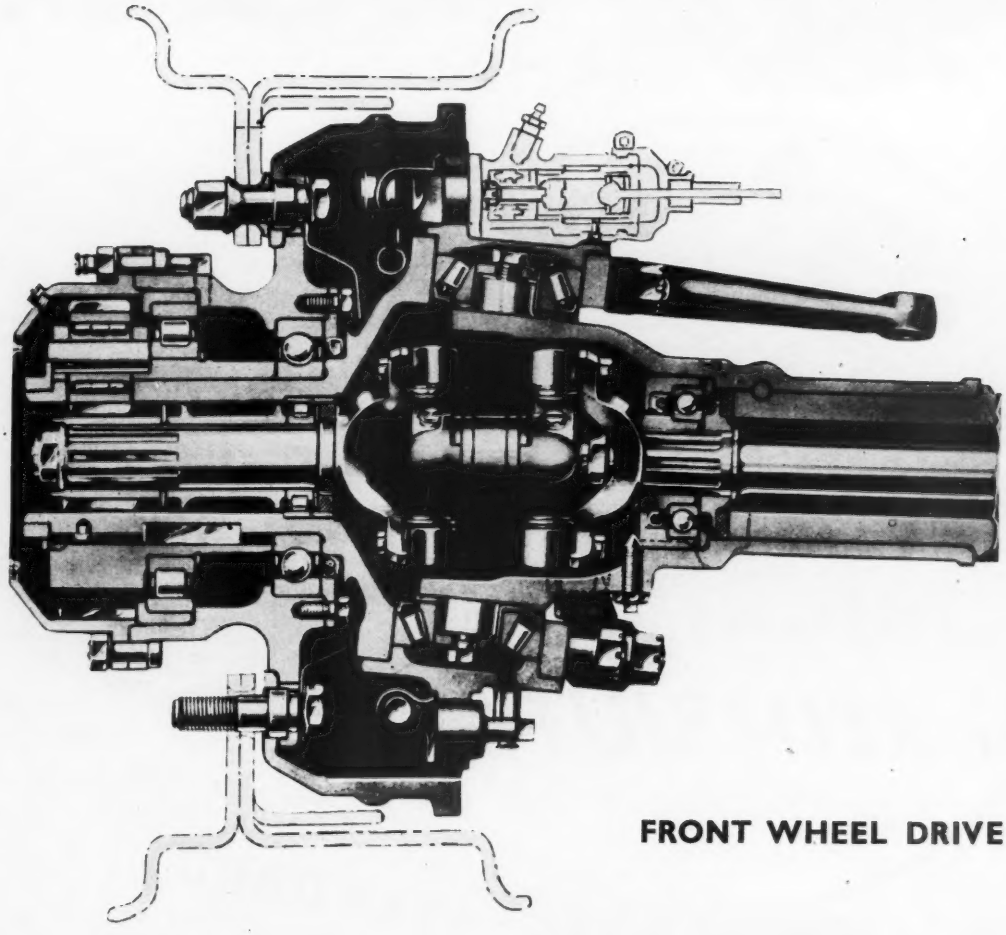
OAK LANE · EAST FINCHLEY · LONDON · N.2.

PHONE · FINCHLEY · 2262

GRAMS · SIMOTUNIT · EASTFINCH · LONDON

A.E.12

KIRKSTALL AXLES



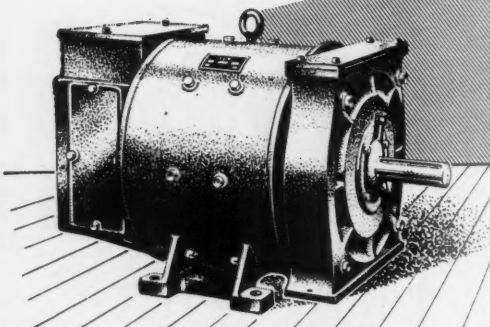
FRONT WHEEL DRIVE

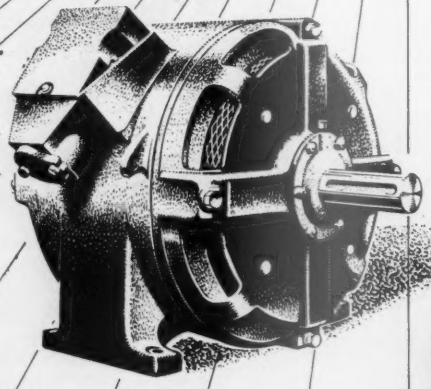
KIRKSTALL FORGE ENGINEERING LTD
LEEDS

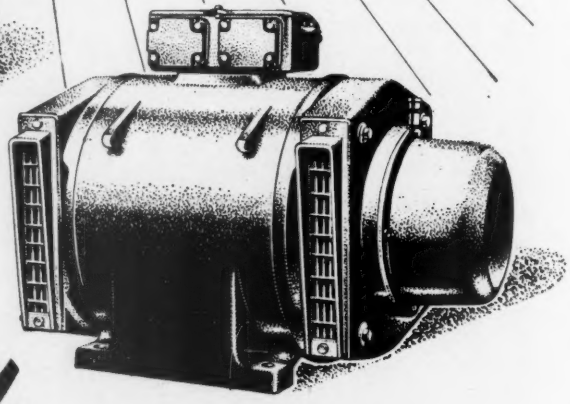
Telephone : Horsforth 2821

They bear the name

G.E.C.







. . . and a name

for *RELIABILITY*

G.E.C. STANDARD

INDUSTRIAL MOTORS

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

FIRTH BROWN 1837–1950

EXPERIENCE & DEVELOPMENT IN HIGHEST QUALITY STEELS OF ALL GRADES

As manufacturers of Alloy Steels for High Duty, Firth Brown's contribution to industry is world wide, whether it be steels for engineering, shipbuilding, automobile, aircraft, road and rail transport or for the most minute mechanisms of the precision engineering industries. Firth Brown Steels were used for parts of the De Havilland "Comet."

LIST OF PRODUCTS

Forgings—Light and Heavy for special and general engineering.

Forged Steel Drums and Pressure Vessels.

Hardened Steel Rolls.

Carbon and Alloy Steel Bars and Billets.

Tyres and Laminated Springs.

High Speed and Tool and Die Steels.

Steel Castings.

Write for the Firth Brown Buyers' Guide for further particulars.

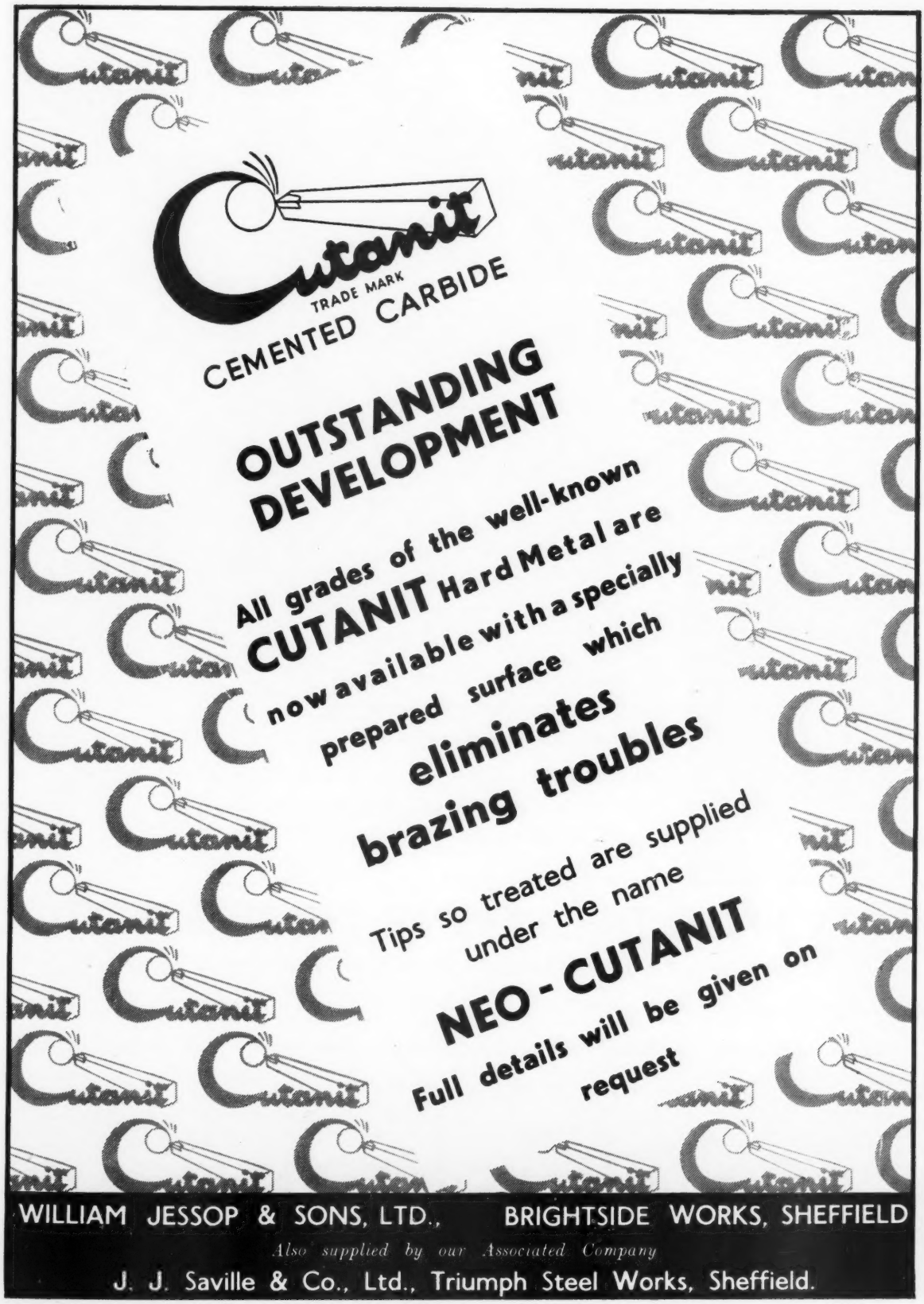
THOS. FIRTH & JOHN BROWN LTD., SHEFFIELD

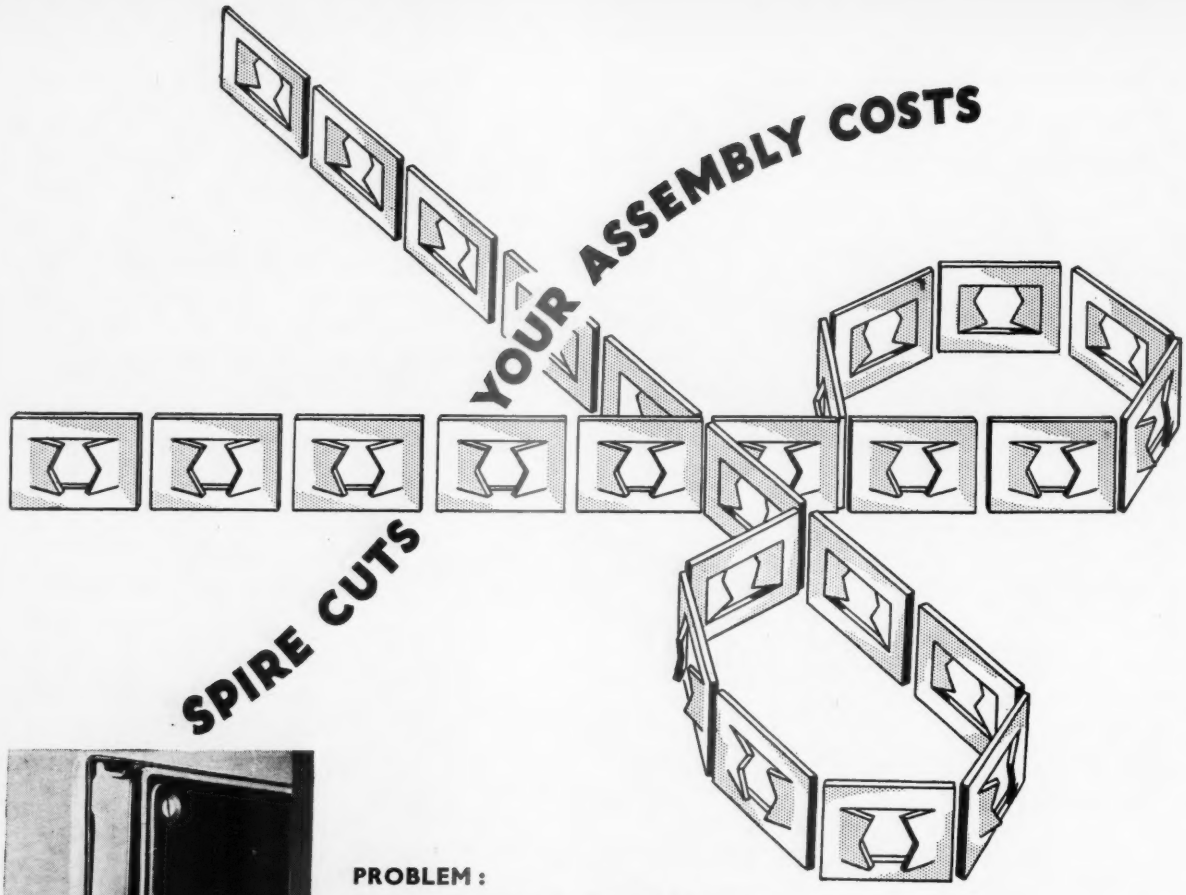
Unique

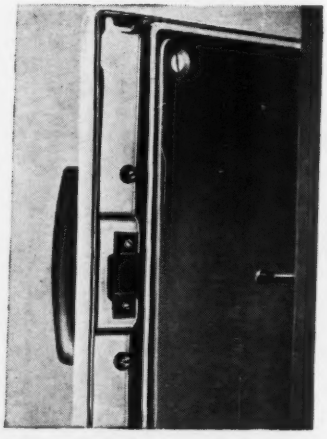
"Newallastic" bolts and studs have qualities which are absolutely unique. They have been tested by every known device, and have been proved to be stronger and more resistant to fatigue than bolts or studs made by the usual method.

C. P. Newall & Co., Ltd.

POSSILPARK GLASGOW · N


Cutanit
TRADE MARK
CEMENTED CARBIDE
OUTSTANDING DEVELOPMENT
All grades of the well-known CUTANIT Hard Metal are now available with a specially prepared surface which eliminates brazing troubles
Tips so treated are supplied under the name
NEO - CUTANIT
Full details will be given on request
WILLIAM JESSOP & SONS, LTD., BRIGHTSIDE WORKS, SHEFFIELD
Also supplied by our Associated Company
J. J. Saville & Co., Ltd., Triumph Steel Works, Sheffield.





PROBLEM :

To close cooker door securely on main body, and ensure that it can be opened and shut in the fastest and easiest way.

SOLUTION :

Spire Spring Latch Type SRV and ball stud. Just a direct pull frees the ball stud.

THAT'S FIXED THAT—FASTER, CHEAPER, BETTER

Here's another cost saver. SRV type Spire Speed Clips afford a simple spring latch for removable assemblies such as doors on refrigerators, cookers, cabinets, inspection covers, etc. Spire fasteners — "the fastest thing in fastenings" — are saving assembly time and cost on thousands of jobs. Why don't you find out what they can do for you? Write direct to us.

Spire *Regd.* **SPEED NUTS**

ENQUIRIES TO: SIMMONDS AEROCESSORIES LTD., BYRON HOUSE, 7-8-9 ST. JAMES'S STREET, LONDON, S.W.1
HEAD OFFICE AND WORKS: TREFOREST, GLAMORGAN.
ALSO BIRMINGHAM, STOCKHOLM AND MELBOURNE.

208

MORE about the METACONE*

In a previous advertisement we pointed out the several factors which combine to give the high load capacity and retention of resilience of our patent **'METACONE'** mountings.

These features include, first and foremost, the use of specially-formed inner and outer sleeves, to both of which the rubber is bonded by the famous Metalastik rubber-to-metal weld, utilizing the rubber to the best advantage in compression as well as shear, and moreover, avoiding creep and consequent permanent set, the enemies of high loading and consistent performance.

This successful design, developed by a wealth of technical resources and carried into practice by our exclusive manufacturing process, is available in the special type illustrated, where the rate is greater in one horizontal direction than the other, a valuable feature in many applications.

These mountings were designed expressly as engine mounting units but are suitable also for other vibration absorbing applications where the main load is in the vertical direction. The two different horizontal stiffnesses can be used to combine lengthwise constraint with transverse freedom and the built-in bump and rebound stops absorb the starting and stopping kick and prevent overload.

*Trade Mark

METALASTIK

METALASTIK LTD., LEICESTER

SCOTLAND'S · LARGEST · AND · MOST · HIGHLY · MECHANISED · ALUMINIUM · FOUNDRY

CASTING TERMS MISINTERPRETED

'CHILLS'

" Where heavy sections of a casting present difficulty in normal feeding technique, metal chills are inserted in the surface of the sand mould to ensure uniform solidification of the metal".

Just another reason why you can and should RELY ON RENFREW

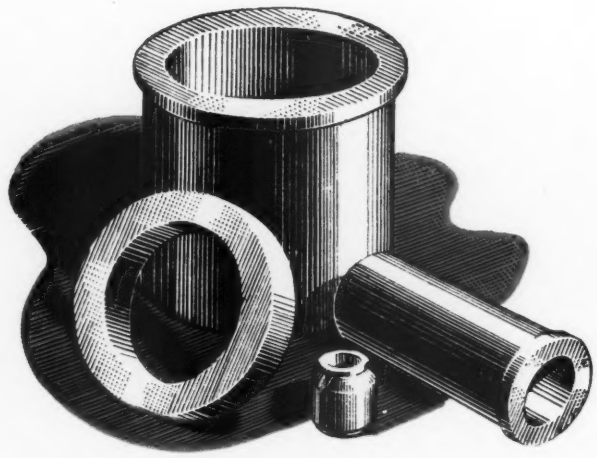
Renfrew Foundries wish their many friends a Happy Christmas and Prosperous New Year

RENFREW FOUNDRIES LTD

IN ASSOCIATION WITH ALMIN LIMITED FARNHAM ROYAL BUCKS

HILLINGTON · GLASGOW · S·W·2 *Tel: HALFWAY 3391*

RF



These bearings reduce friction, smoothing machine operation

Compo bronze bearings start with a big advantage for they have a natural asset in their make-up. They are die pressed from powdered metals and have a porous structure producing myriads of minute reservoirs which are charged with lubricating oils. This ensures a constant oil film on the shaft, increasing or decreasing according to shaft speed and bearing temperature. Compo bearings cut down servicing time and increase machine output.

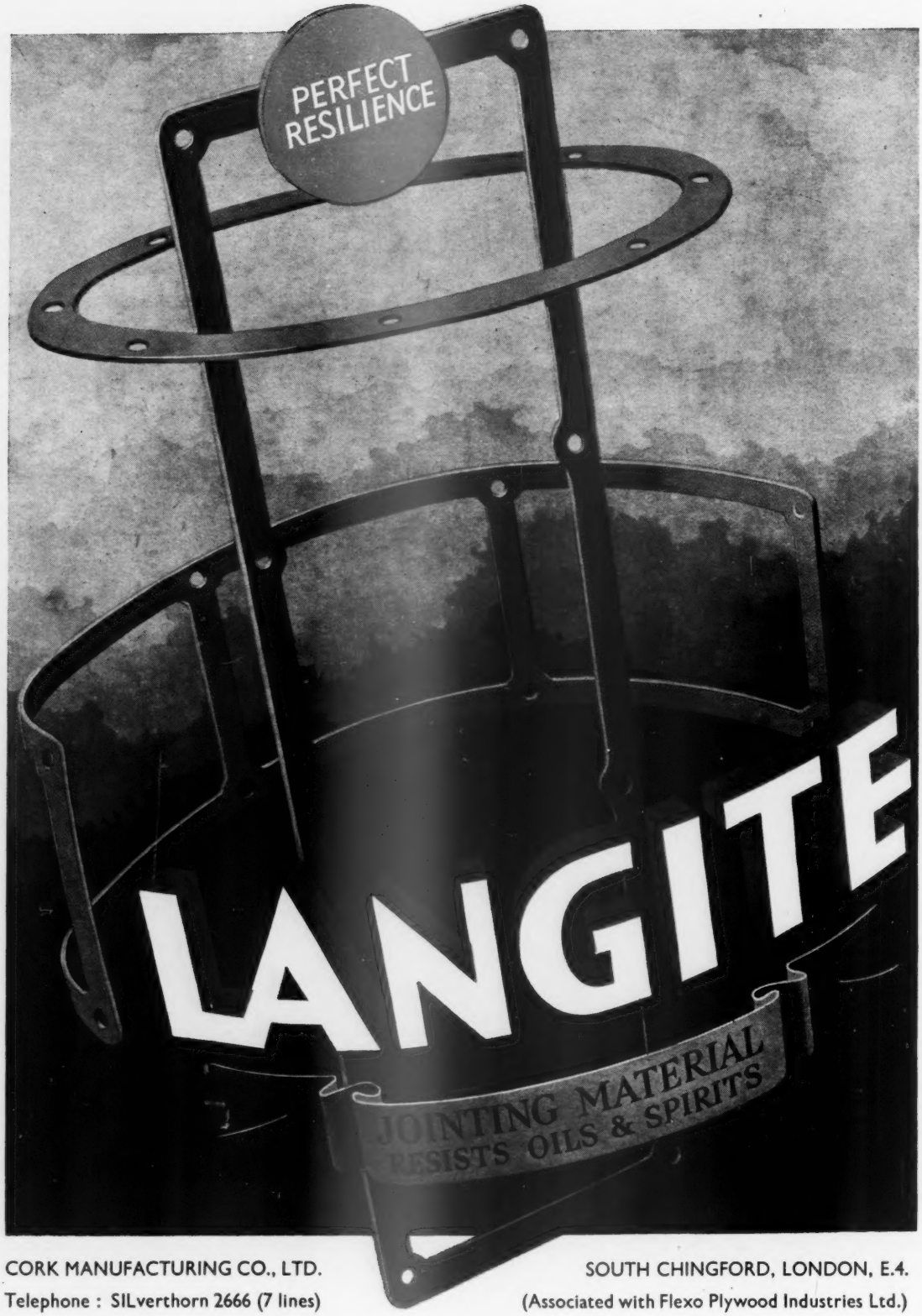
COMPO

oil retaining

BEARINGS

BOUND BROOK BEARINGS (GB), LTD., BIRCH ROAD, WITTON, BIRMINGHAM 6

a Birfield Company



CORK MANUFACTURING CO., LTD.
Telephone : SILverthorn 2666 (7 lines)

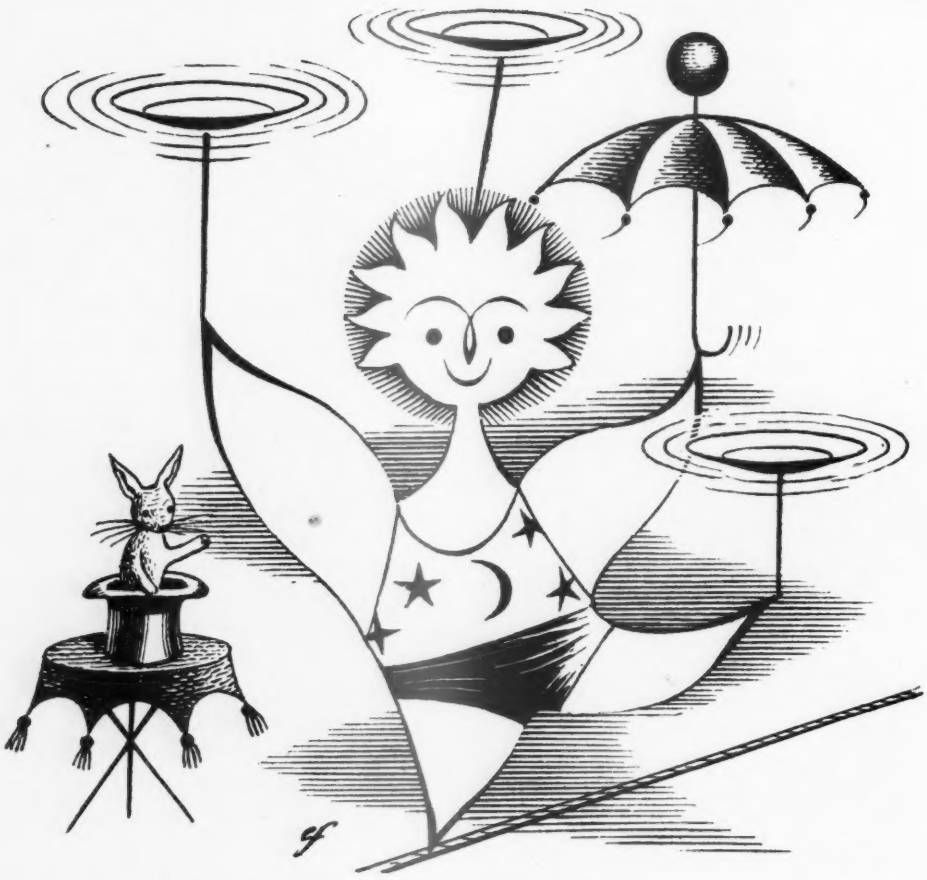
SOUTH CHINGFORD, LONDON, E.4.
(Associated with Flexo Plywood Industries Ltd.)

Are your conveyors saving you enough?

YOUR ELECTRIC MOVING BELTS, your hoists and fork lifts save you time and labour—but are you sure you could not save even more—and use less power in doing so? Electrical conveying and handling plant works quickly and efficiently. Very few people are needed to operate it, and they need not be highly skilled. The plant creates neither noise nor smell, and its useful life is exceptionally long.

Electricity for PRODUCTIVITY

Your Electricity Board are anxious for you to get the utmost value from your power supply. They have an expert staff who will be only too glad to help you. Their advice is at your disposal any time you want it. You have only to ask. Or you can write to the British Electrical Development Association, 2 Savoy Hill, London, W.C.2.



I'VE GOT AMAZING SELF-CONTROL! says Mr. Therm

When you call in Mr. Therm to solve your fuel problems, you get more than just a very willing worker. You get one that is capable of self-adjustment and rigid control of fuel consumption. You can cheerfully set the controls and leave gas-heated equipment to get on with the job *by itself*, for as long as you like. There are other advantages too, of course: cleanliness, flexibility, rapid heating from cold and high efficiency. That is why Mr. Therm and his gas equipment are valued members of almost every industry's productive staff.

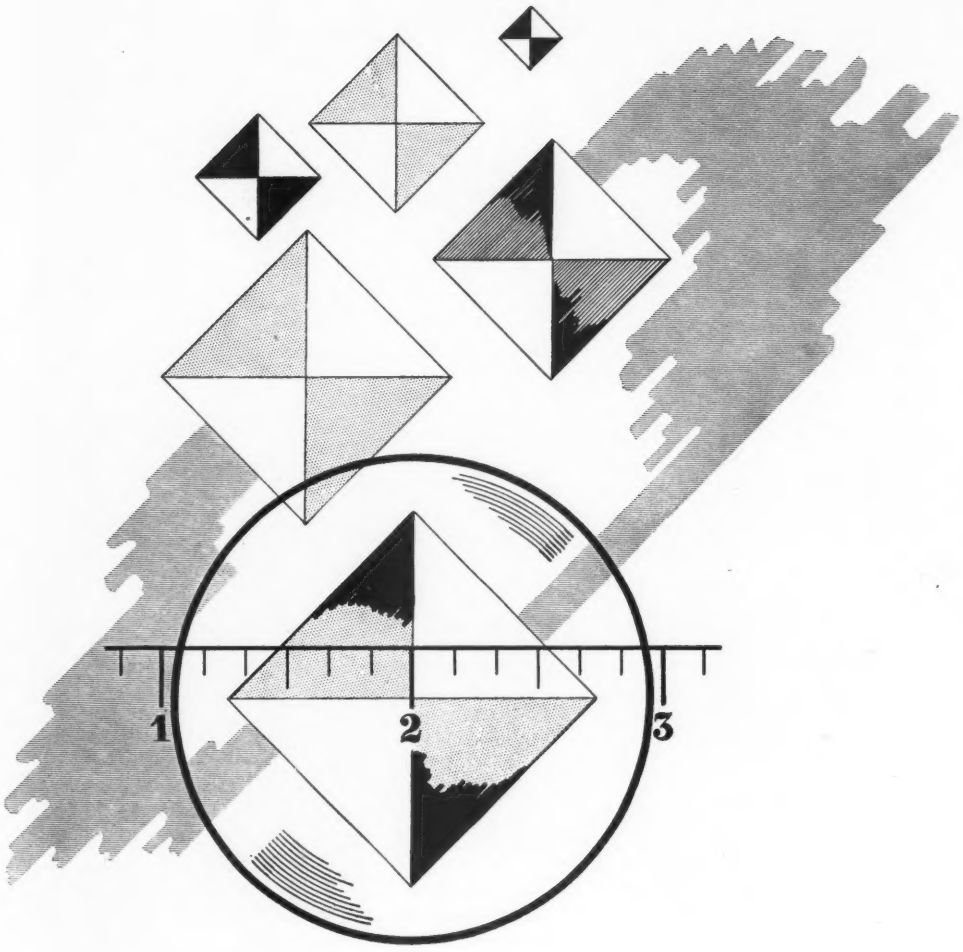
Mr. Therm on a bicycle made for millions

Gas, in its variety and ease of control, is a great help to B.S.A. Cycles Ltd., of Birmingham. Gas equipment takes care of carburising, hardening and tempering; brazing of the joints on frames and handlebars; enamelling. And gas does a good job, too, in the making and finishing of many bicycle accessories.

MR. THERM BURNS TO SERVE YOU

THE GAS COUNCIL · 1 GROSVENOR PLACE · LONDON · SW1

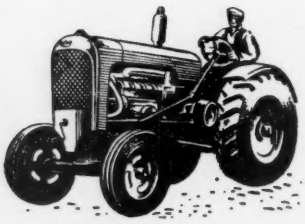
HOW HARD ?



The illustration is of indentations produced in metal test pieces by a polished diamond indenter applied under known pressure. The superimposed scale is the graticule in a microscope whereby the impression is measured. The harder the metal the smaller the indentations.

LM VAN MOPPES & SONS (DIAMOND TOOLS) LTD

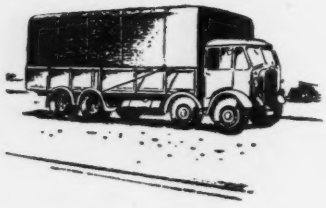
DIATIPT WORKS · NORTH CIRCULAR ROAD · LONDON, N.W.2. GLADSTONE 8221



INSTANT STARTING

ALL ENGINES

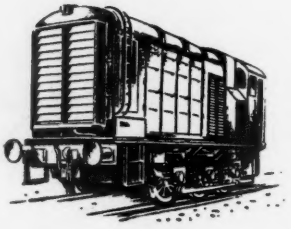
UNDER ANY CONDITIONS



The Bryce-Berger Handraulic Starter provides an entirely new system of engine starting based on a combination of well proved engineering practices.

The Starter has only three moving parts
It relies on no outside source of energy
Its first cost is low and its operating cost negligible
It is simple to fit and completely reliable
The *flame-proof* starting problem solved

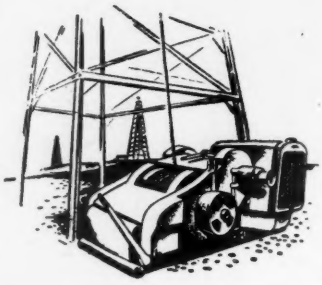
Operation is by hand



It gives certain starting under all conditions and its efficiency is entirely unaffected by extreme operating temperatures.

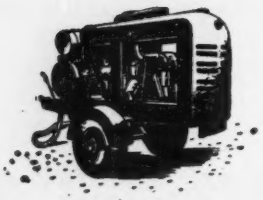
Bryce-Berger spells the end of idle time through starting failures.

Designers and Users of Engines for Contractors Plant, Cranes, Excavators, Tractors, Agricultural Machinery, Vehicles and Power Units for Industrial, Railway, Mining & Marine Purpose should write now for full particulars and details of the construction and operation of the



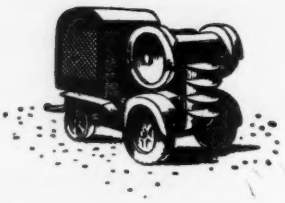
BRYCE BERGER

HANDRAULIC STARTER



BRYCE FUEL INJECTION LIMITED, STAINES

Tel.: Staines 1050 *Grams: Injection, Staines*

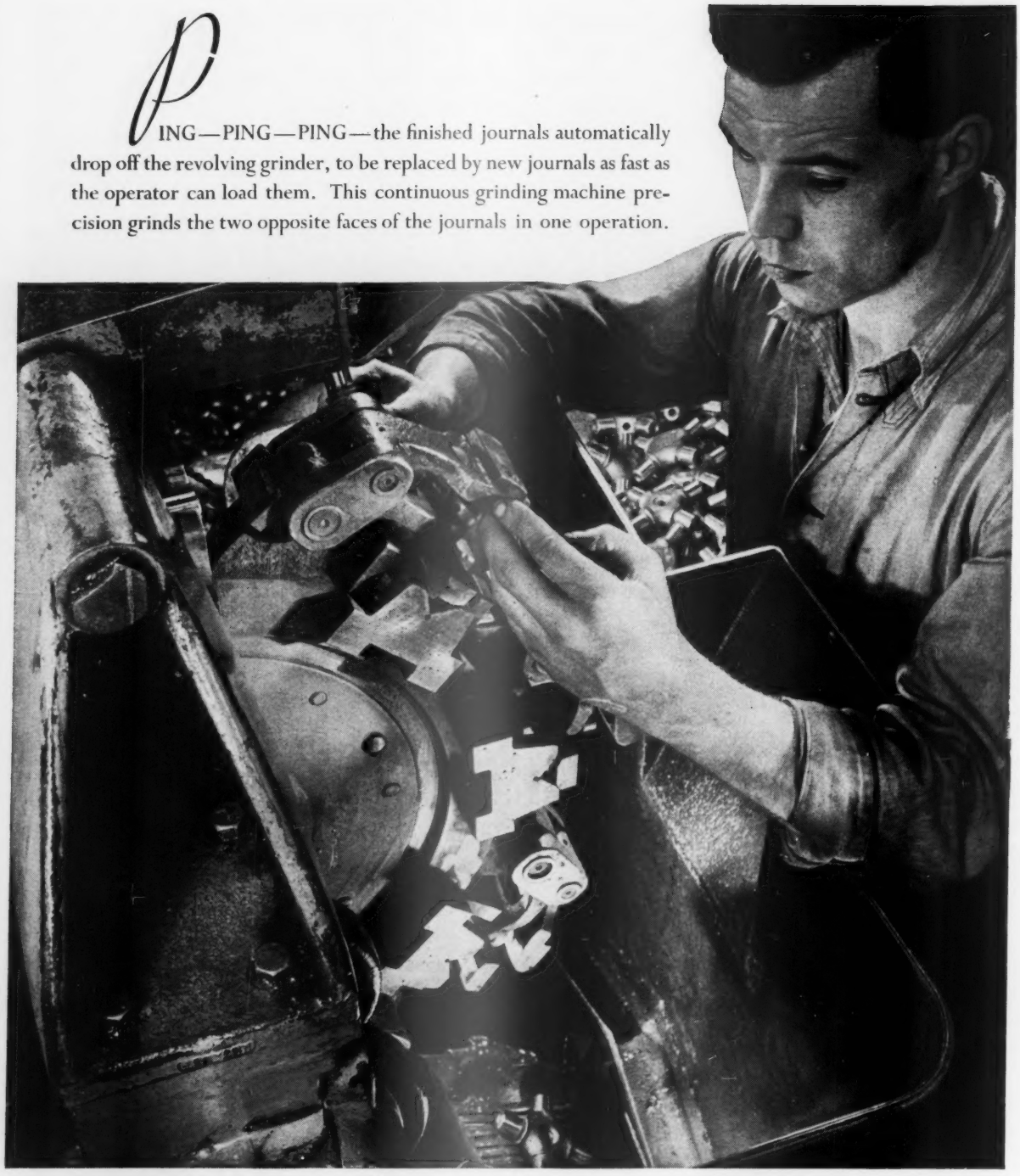


To our many friends....

We extend Best Wishes for Christmas and the New Year

JONAS WOODHEAD & SONS LTD • LEEDS

PING—PING—PING—the finished journals automatically drop off the revolving grinder, to be replaced by new journals as fast as the operator can load them. This continuous grinding machine precision grinds the two opposite faces of the journals in one operation.



HARDY SPICER
NEEDLE BEARING

PROPELLER SHAFTS

Mass produced to high precision standards

HARDY SPICER & CO LTD (*A Birfield Company*) WITTON BIRMINGHAM 6

MADE BY THE PIONEERS
IN PRECISION
STEERING
GEARS

EFFORTLESS STEERING AND GREAT DURABILITY

Hardened cam and roller.

Tapered roller bearings (with detachable cones on the larger sizes).

Double bearing support to rocker shaft.

End-location adjustable.

Large angular movement.

Very compact box.

For fore-and-aft or transverse layout.

Trunnion or spigot mounting alternative on heavy types.

THE 'MARLES' DOUBLE-ROLLER GEAR, made in a range of sizes covering every type of chassis.

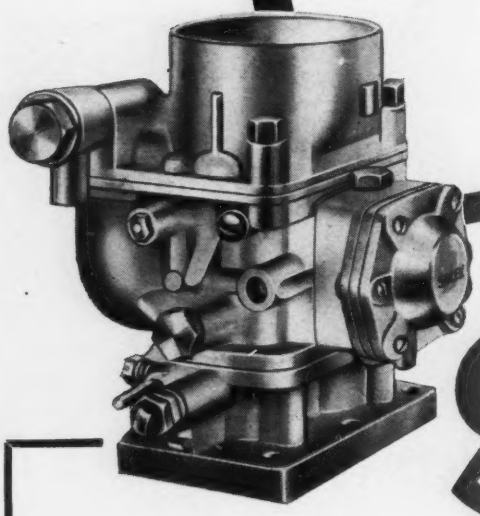
MARLES

ADAMANT

ENGINEERING CO. LTD., DALLOW ROAD, LUTON
Sole proprietors of the Marles Steering Company Ltd.

Telephone : LUTON 2602 (4 lines). *Telegrams : ADAMANT, PHONE, LUTON.*

Carburettor Developments



BY

SOLEX

Latest Technical Features in

1 SINGLE THROAT DOWNDRAUGHT CARBURETTORS

2 TWIN THROAT DOWNDRAUGHT CARBURETTORS

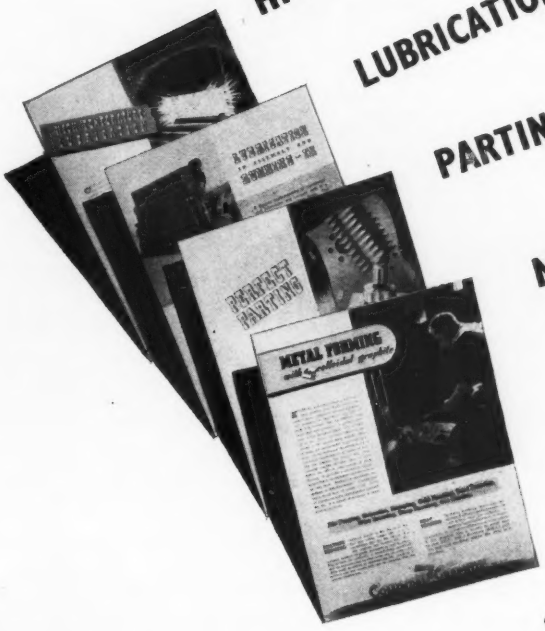
Both Embody:

(a) *Acceleration and economy device, depression or mechanically operated.*
(b) *Dustproofing: for longer cylinder bore life.*

CO-OPERATIVE TESTS INVITED

SOLEX LIMITED, SOLEX WORKS, 223-231 MARYLEBONE ROAD, LONDON, N.W.1

4 aids to INCREASED production!



HIGH TEMPERATURE LUBRICATION

LUBRICATION IN ASSEMBLY & IN RUNNING-IN

PARTING

METAL FORMING

Each of these four Acheson Bulletins aids increased production—by solving a vital problem. All concerned with industrial efficiency should send for their copies today.

Post this Now!

Acheson Colloids is equipped to do disintegrating, dispersing and stabilising of solids in a wide variety of liquids. The dispersing of solids in resins, plasticisers and solvents is one of our specialities. If you are in need of this type of service, consult us. We may be able to help you.

ACHESON COLLOIDS LIMITED
18 PALL MALL, LONDON, S.W.1

Please send me a free copy of each of the new 'dag' Colloidal Graphite Technical Bulletins indicated.

- ☐ Lubrication in Assembly & in Running-In
- ☐ Parting
- ☐ High Temperature Lubrication
- ☐ Metal Forming

Name .....

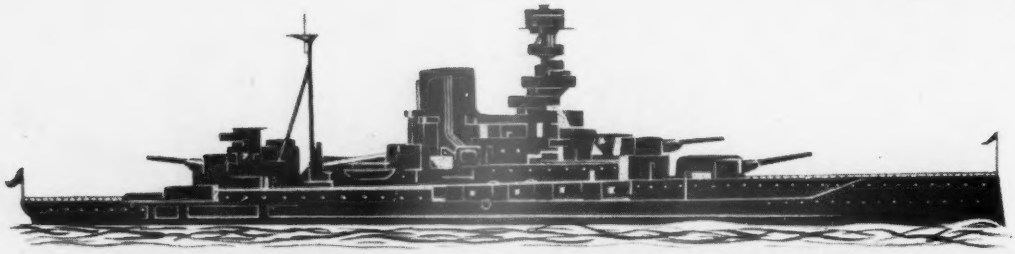
Address .....

D/11

ACHESON COLLOIDS LIMITED
18 · PALL MALL · LONDON · S·W·1

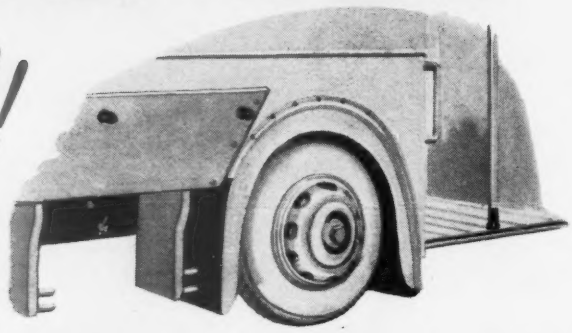
dag REGD TRADE MARK DISPERSIONS

Buses & Battleships



need BOLLARDS

3 SIZES -100 uses!!

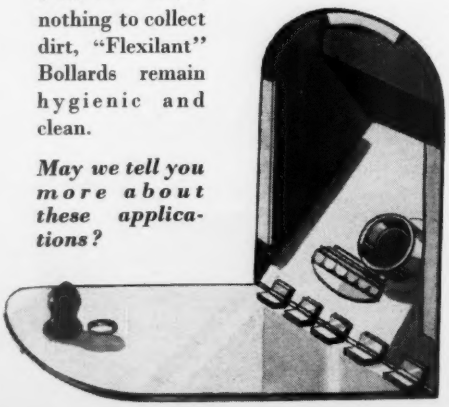


Made now in three sizes and two types, the scope of "Flexilant" Bollards ranges over a large field of the motor industry. These Bollards can, for instance, be used for destination doors, indicator side guard rails, seat backs, stowage panels and locker doors. They are silent, self-placing, inexpensive and at least as long-lasting as the part to which they are fitted. Have you an application in mind for a reliable rubber-bonded-to-metal clinch-grip fixing?

Patent No. 617806

Simply and swiftly a bus lifeguard can be attached by using "Flexilant" Bollards. However, once in position, they remain rigid and firm. A similar fixing is shown on the fuel cover below. With nothing to collect dirt, "Flexilant" Bollards remain hygienic and clean.

May we tell you more about these applications?



EMPIRE RUBBER COMPANY

IN ASSOCIATION WITH RUBBER BONDERS LTD

(PROPRIETORS : H. G. MILES LTD)

DUNSTABLE · BEDFORDSHIRE · ENGLAND

TELEPHONE : DUNSTABLE 533 536 (4 LINES). TELEGRAMS : SPANDIT DUNSTABLE

R.B.77

BERRY ON RECORD

To drive 10,000 miles in 166 hrs. 39 mins. —an average speed of 60 m.p.h.—is a noteworthy achievement for any class of car, yet this was the performance of an AUSTIN A.40 saloon on the Montlhery track near Paris, a short time ago. It was one of the 161 records established by AUSTIN stock cars during 1949/50, magnificent performances which proved beyond doubt that British automobile engineering is still second to none. They also provided further confirmation of the unsurpassed quality of Berry Springs, fitted to all the cars used in the record attempts.

Richard Berry & Son have played their part in the setting up of countless records; but the proudest record of them all is the 100 years of faithful service which the firm has given to vehicle manufacturers. When the motor industry was born, Berry's helped to foster it, and the name stands high in the esteem of those who appreciate the value of high-grade laminated springs.

Born before
the motor industry,
Berry still provides all that
is best in vehicle suspension

CARRY ON BERRY

CARRY ON BERRY

RICHARD BERRY & SON · MAFEKING ROAD · SMETHWICK

CLEVELAND
GUARANTEED
CLEVECOL
SERVICE TELLS
" My experience confirms their claim to be specialists in the distribution of Petrols through the Trade "
says Mr. Dealer.
SERVICE
CLEVELAND
CLEVECOL
J. CAMMING

IN FAR-AWAY PLACES

SOUTH OF THE PANAMA

Wherever there are revolving parts demanding bearings, there you will find stocks of R&M Bearings ready to hand to give that friction-free service for which they are renowned.

R&M BEARING STOCKS in SOUTH AMERICA including ARGENTINE, PARAGUAY, URUGUAY and BRAZIL at:

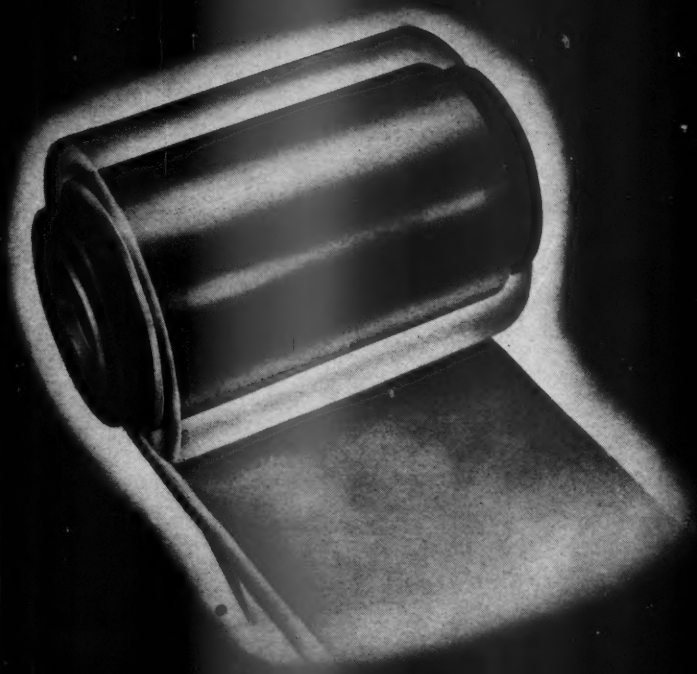
BUENOS AIRES	RESISTENCIA
RIO de JANEIRO	MONTEVIDEO
ROSARIO	PORTO ALEGRE
SAO PAULO	SANTOS
BAHIA BLANCA	SANTIAGO
TUCUMAN	ASCUNCIAN
MENDOZA	RECIFE
CHIVILCOY	MACEIO
JUNIN	SAO SALVADOR
PERGAMINO	CAMPOS
M. del PLATA	CHACUBUCO
CURITIBA	BELO HORIZONTE

BALL & ROLLER R&M BEARINGS

RANSOME & MARLES BEARING CO. LTD., NEWARK-ON-TRENT, ENGLAND

K/RM.66.

FITTED TO THE WORLD'S BEST CARS

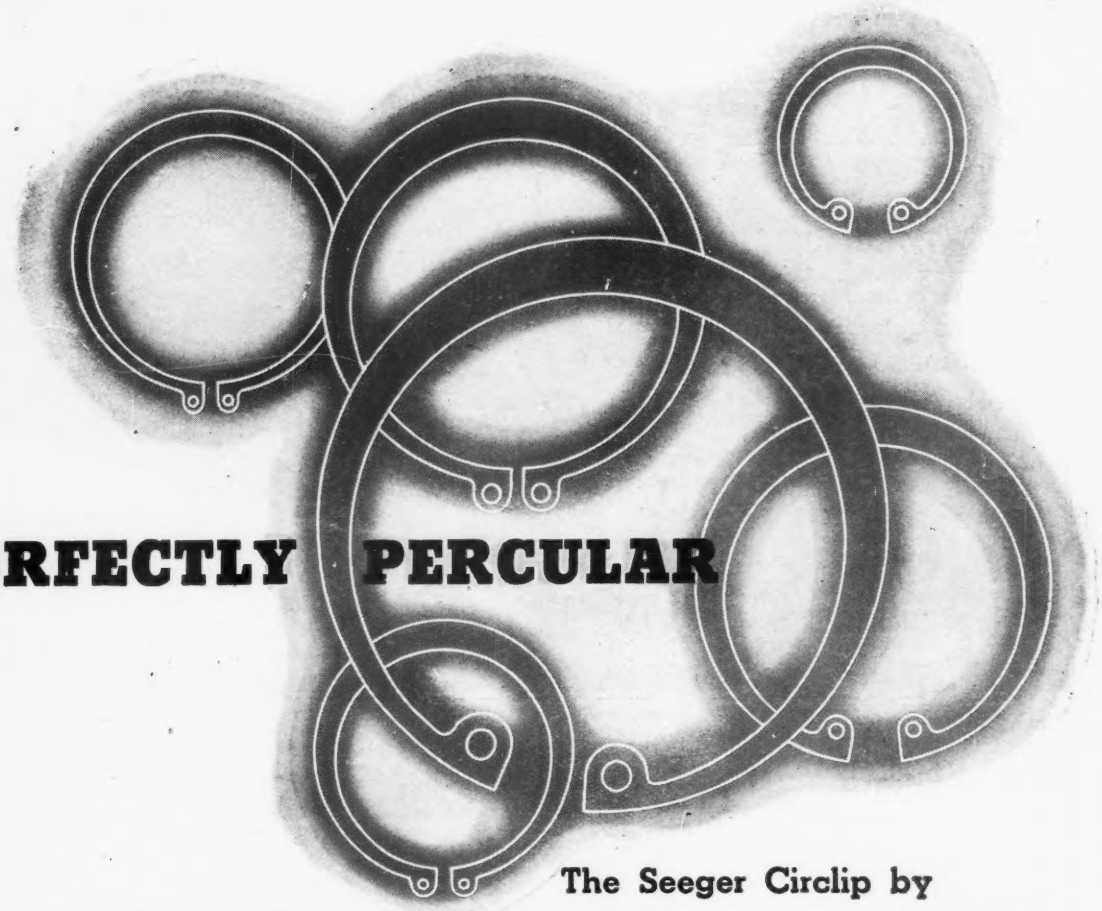


SILENTBLOC

Flexible

BEARINGS

SILENTBLOC LIMITED VICTORIA GARDENS LONDON W.11. TEL. PARK 9821



SERFECTLY PERCULAR

The Seeger Circlip by virtue of having its width tapered in accordance with scientific principles is the only circlip which always remains truly circular on the contact periphery. Don't let it tie you into knots. In simple words it means that a Seeger Circlip seats deeply in its groove all round, because when fitted it is serfectly percular . . . circliply percular . . . **perfectly circular . . .**

SEEGER CIRCLIPS

THE AUTOMOTIVE ENGINEERING CO. LTD., THE GREEN, TWICKENHAM, MIDDX.
Telephone: Popesgrove 2206 (P.B.X.) **Telegrams: Motif, Twickenham**

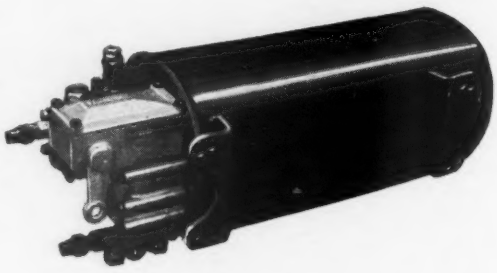
Smee's

CLAYTON DEWANDRE
STORAGE & CONTROL UNITS

APGA.4436A

Single Air Pressure Reservoir complete with Brake and Unloader Valves for normal brake application.

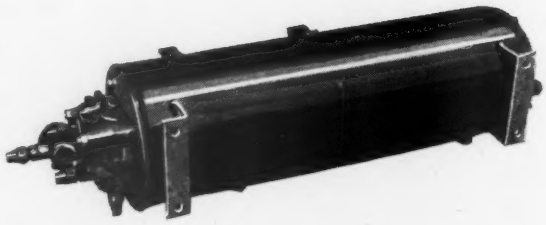
Fitted to A.E.C. 'Matador' and 'Mammoth Major' Vehicles.



APGA.4420-1

Twin Air pressure Reservoir complete with Composite Valve, providing a quick available reserve of air pressure for power braking and gearbox operation, as well as air storage at maximum pressure.

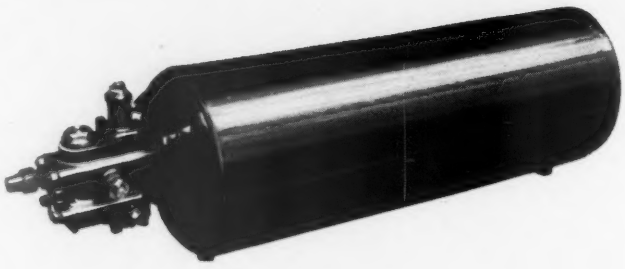
Supplied for London Transport's R.T. type buses.



APGA.4416

Single Air Reservoir complete with Unloader and Safety Valves—recommended for all types of road vehicle.

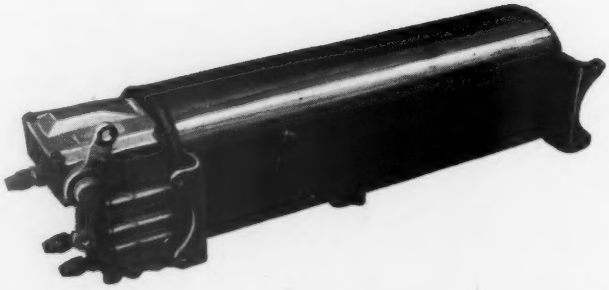
Supplied to Messrs. Scammell Lorries Ltd. for their cross-country 6 x 6-vehicles.



APGA.4434

Single Air Pressure Reservoir complete with Brake, Change-Speed and Unloader Valves providing air for brake and gearbox operation.

Fitted to A.E.C. 'Regent' and 'Regal' Mark III Chassis.



FOR AIR PRESSURE BRAKING

CLAYTON DEWANDRE CO. LTD. TITANIC WORKS LINCOLN 1156-7

A.P.9

such different types...

Every day many Gear Reduction Units leave Holroyds and hurry out to face a coldly critical world — a world that demands quality and quick delivery in the same gulping breath. We watch our little Units go with high hopes. Vastly different characteristics they have indeed but in all essentials... ah... they are the same... trustworthy ... hard working... strong... and they... ah... bear the same noble stamp... they ah... aw, drat the brats. We know they will acquit themselves like Holroyds and never let the old name down.

Holroyd Totally Enclosed Worm Gear Reduction Units are made in the following types: UNDER-DRIVEN (Worm under wheel). In standard sizes from 3 in. to 24 in. centre distance of worm and wheel. OVERDRIVEN (Worm over wheel). 3 in. to 24 in. centres. VERTICAL (Vertical output shaft). 3 in. to 24 in. centres. Output shaft may project up or down. DOUBLE REDUCTION. For ratios from 70/1 up to 2000/1 or more. F TYPE for fractional or small horsepowers. Made in three sizes — 1⅛, 1¾, 2½ in. centres. Choice of shaft projections. All units have ball or roller bearings throughout, nickel steel casehardened and ground worm and Super Holfos bronze wheel, centrifugally cast. STANDARD RATIOS: 7½ 10 15 20 25 30 40 50 60.

Holroyd Gear Reduction Units *JOHN HOLROYD & CO. LTD., MILNROW · LANCASHIRE*

CRC 146

INDUCTION HEATING EQUIPMENT

Brings high speed flow-line production to soldering, brazing and heat treatment operations

COMPACT EQUIPMENT occupies minimum floor space.

INFINITELY VARIABLE POWER CONTROL by means of a single knob (7½ and 25 kw. units).

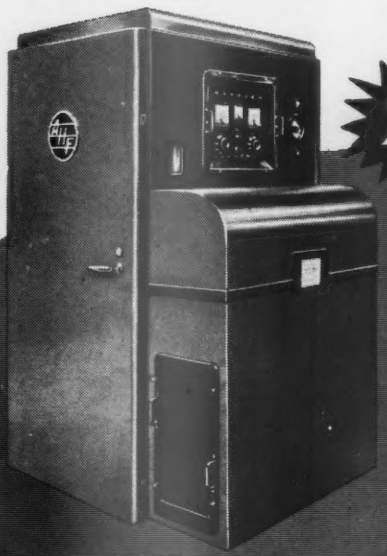
FULLY PROTECTED CIRCUITS with tell-tale indicator lights (7½ and 25 kw.).

AUTOMATIC SHUT-DOWN PROTECTION should water and air circulation become insufficient.

SILICA ENVELOPE VALVES, guaranteed for 1,500 working hours, can be repaired, reducing by 50% normal cost of valve replacement.

EASY SERVICING. Equipments are unit-built and factory-built replacements can be installed as sub-assemblies.

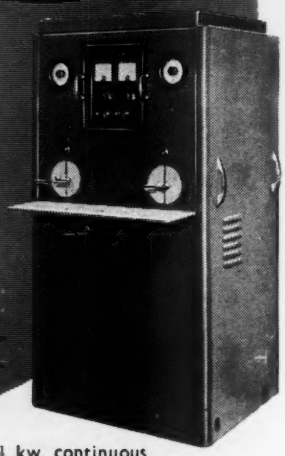
Output power: 25 kw. continuous, 35 kw. at 50% duty cycle with a maximum heating time of 8 seconds. Output frequency: 250-600 kcs. Power supply: Standard voltage 50/60 cycle, three phase, four wire. Power consumption: 50 kw. at full output, 4 kw. on standby. Power factor: 0·87 at full load.



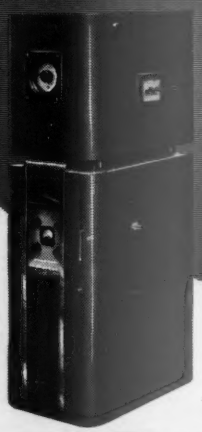
25 KW.

TWO STATION SWITCH

Can be incorporated in any equipment, and speeds flow line production on many heating jobs. One station can be loaded whilst the heating cycle is in progress at the other and, if necessary, two dissimilar jobs can be treated on the same production run.



1 KW.



A compact unit suitable for numerous soft soldering, brazing and hardening applications. When delivering 1 kw. main loading is approx. 2 kw. with a power factor of approximately 0·9. Suitable for connection to 200/250 v. single phase, 50 cycle supply.

7½ KW.

Output power: 7½ kw. continuous. Higher output can be obtained for short duty cycles. Output frequency: two m/cs. Power supply: standard voltage 50 cycle, three phase, four wire. Power consumption: 15 kw. at full output, 600 watts at standby. Power factor: 0·9.

SPECIALISTS IN MECHANISED INDUCTION HEATING

APPLIED HIGH FREQUENCY LTD.

ACTARC WORKS, GOLDHAWK RD., LONDON, W.12

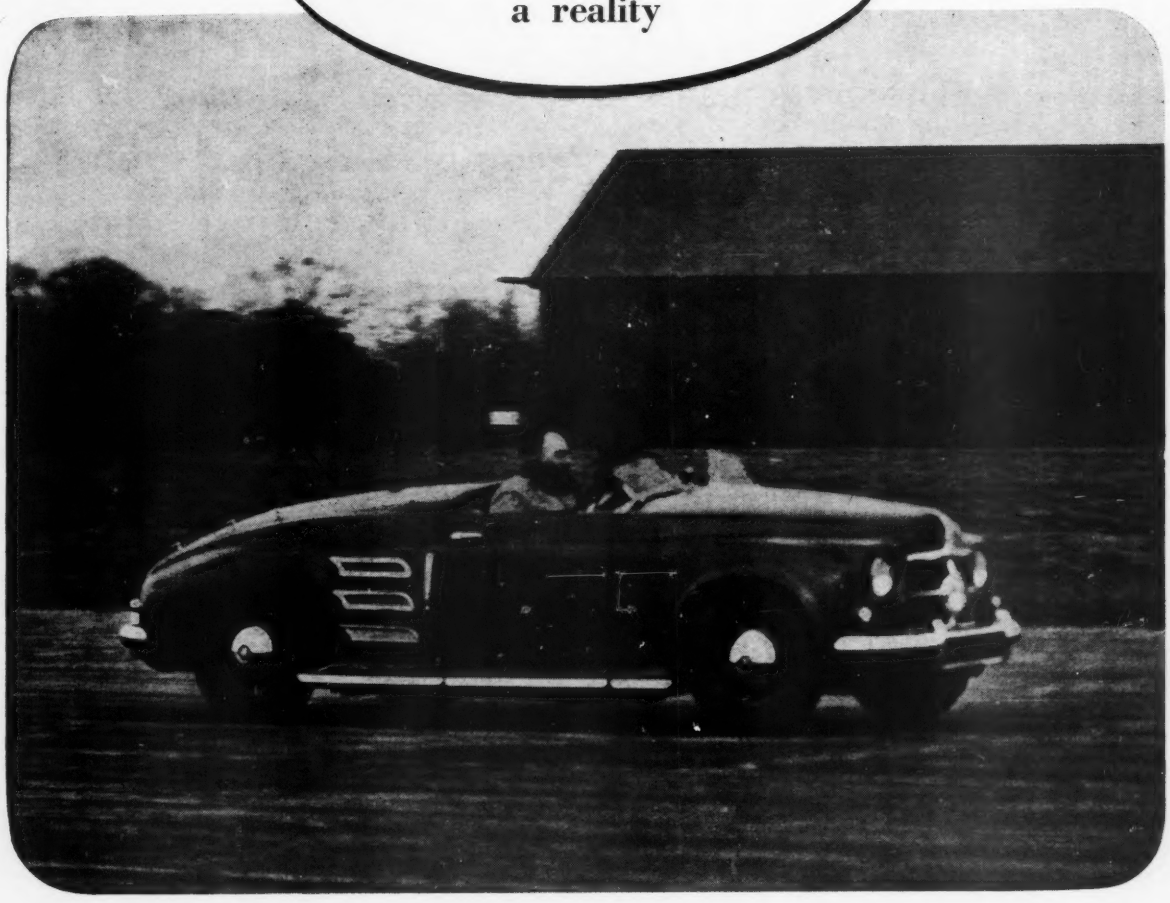
TELEPHONE : SHEPHERDS BUSH 1151

140 F1

36/HT/16A

NIMONIC

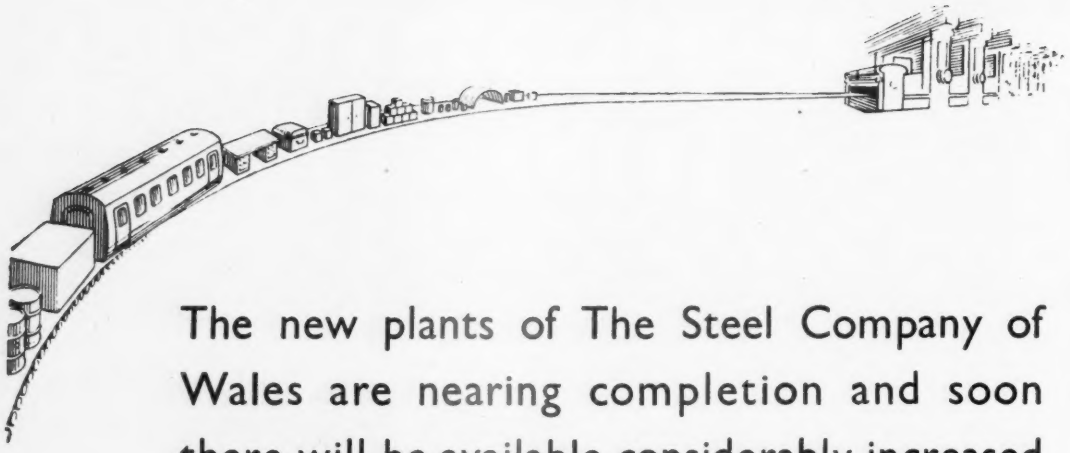
Alloys made the Gas Turbine a reality



Rover made history with their new Turbo Car. Henry Wiggin made the Nimonic Alloys used for such vital parts as Discs and Turbine Blades, Combustion Chambers and Internal Ducting.

Nimonic is a registered trade mark

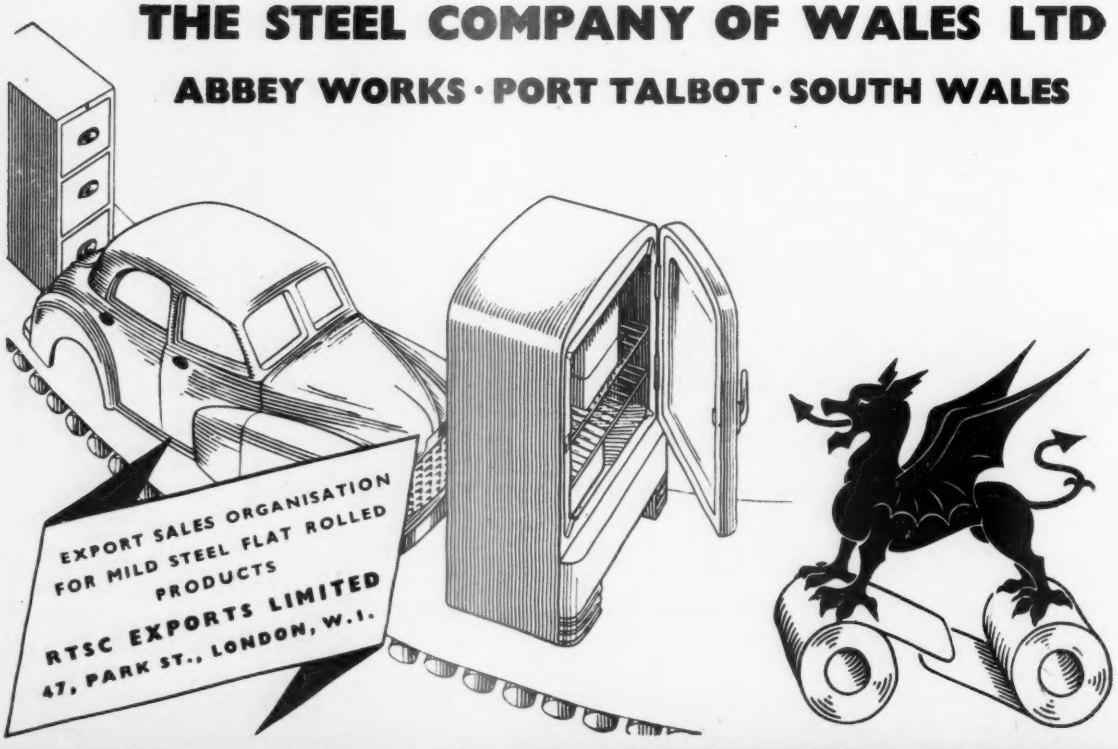
HENRY WIGGIN AND COMPANY LTD · WIGGIN STREET, BIRMINGHAM 16



The new plants of The Steel Company of Wales are nearing completion and soon there will be available considerably increased quantities of Steel Sheets—**up to 72″ wide**—for motor cars, drums, railway carriages and wagons, refrigerators, general engineering and sheet metal work, etc. in best quality open hearth steel.

THE STEEL COMPANY OF WALES LTD

ABBEY WORKS · PORT TALBOT · SOUTH WALES



James Booth

for COPPER and BRASS

Seamless and brazed tubes (round and shaped)
Extruded rods and sections
Phosphor-bronze tubes for pressure gauges
Condenser tubes in brass,
aluminium-brass and cupro-nickel
Copper stay bars (solid and hollow)
Large forgings in brass and other copper alloys
Formed strip sections
Drawn strip and wire
Rolled sheet and stirp

BOOTH
BIRMINGHAM

JAMES BOOTH & COMPANY LTD . ARGYLE STREET WORKS · BIRMINGHAM 7

BBI

All YOUR NEEDS FULFILLED

Everything required in a radial drill is embodied in this Archdale hydraulically controlled machine. This catalogue will convince you . . . .

JAMES ARCHDALE & CO. LTD., BIRMINGHAM

Sole Agent : ALFRED HERBERT LTD. COVENTRY.

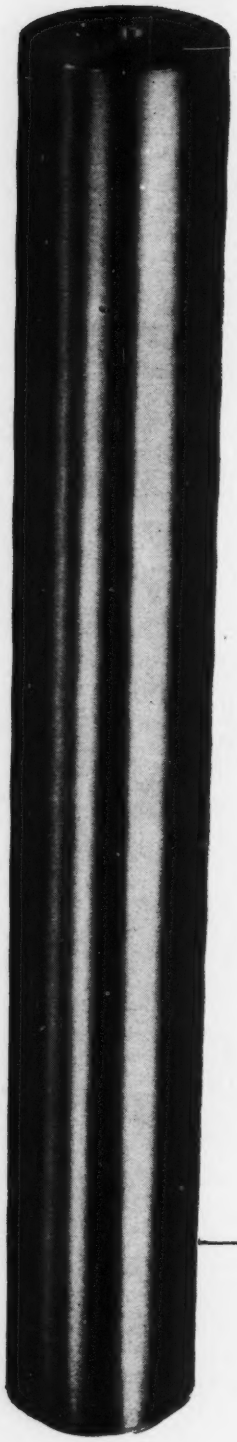
STERLING

Castings for the Triumph Mayflower

STERLING METALS LTD. COVENTRY

By courtesy of the Standard Motor Co. Ltd.

TELEPHONE: COVENTRY 89031 (6 lines) · TELEGRAMS: STERMET · PHONE · COVENTRY



bronze

Those who make bronze bushes from 'as cast' material may find it worth while to consider our new range of machined bronze bars.

These only need cuts of ·015" in the bore and ·010" on the outside diameter to produce a finished size.

By the use of these standard bronze bars considerable savings in machining time, tool wear and swarf wastage are made.

May we send you a leaflet of sizes and specifications?

OTHER GLACIER BEARING PRODUCTS

WHITE METALS

STANDARD BRONZE BUSHES

HALF BEARINGS AND BUSHES

STANDARD WRAPPED BUSHES

THE GLACIER METAL CO. LTD.
ALPERTON, WEMBLEY, MIDDLESEX.
Telephone: PERivale 4271
Telegrams: BEAUCOUP, WESPHONE, LONDON

All of them fit EATON 2-Speed AXLES!

Eaton 2-Speed Axles are now fitted by the makers of all these vehicles to appropriate models. This fact in itself is proof of the success of Eaton Axles and of the demand from knowledgeable vehicle operators for the great advantages of two complete speed and power ranges available in one vehicle.

Use HIGH ratios (equivalent to an overdrive for all gears) for time and fuel-saving schedules on good fast work; use LOW ratios for reserve of power in all gears for difficult loads and conditions.

Write for full particulars.

Leyland

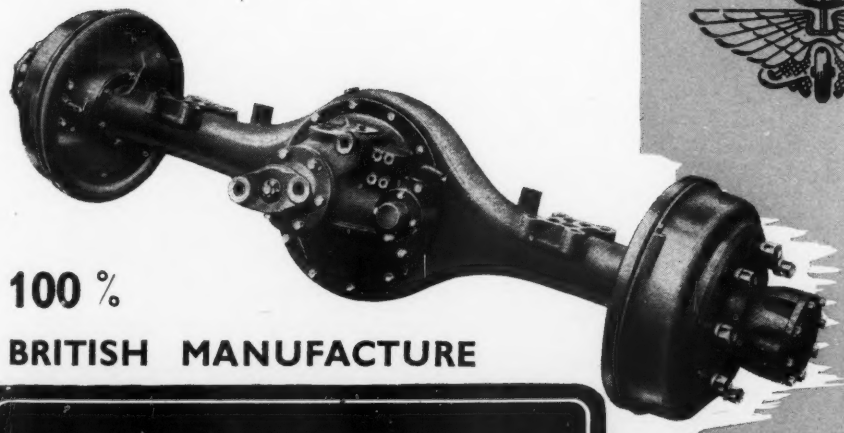
DODGE

Seddon

BEDFORD

AUSTIN

COMMER



VULCAN

100 %

BRITISH MANUFACTURE

DENNIS

GUY

THORNYCROFT

EA

EATON

2-Speed **AXLES**

EATON AXLES LIMITED ● **25 VICTORIA ST., LONDON, S.W.1**

ENGLAND

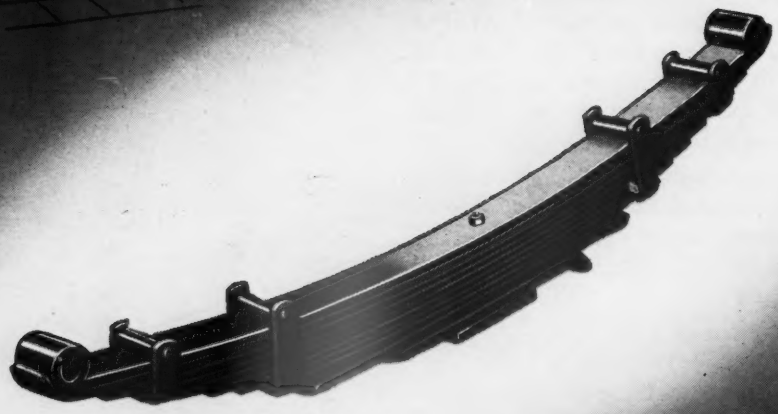
In association with —

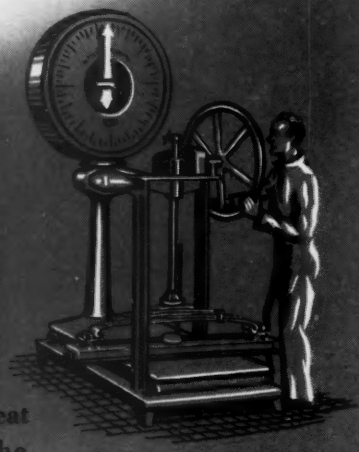
EATON MANUFACTURING CO., CLEVELAND, OHIO, U.S.A · E.N.V. ENGINEERING CO. LTD., LONDON, N.W.10 · RUBERY OWEN & CO. LTD., DARLASTON

Telephone: ABBEY 6471

OVER A MILLION EATON TWO-SPEED AXLES IN TRUCKS TO DAY

ROAD SPRINGS





As we roll our own steel, the Heat Treatment is controlled from the Billet to the finished Spring

SPRINGS FOR EVERY PURPOSE

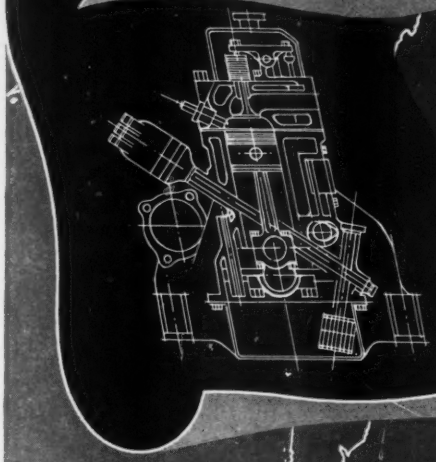
COCKER BROS LTD

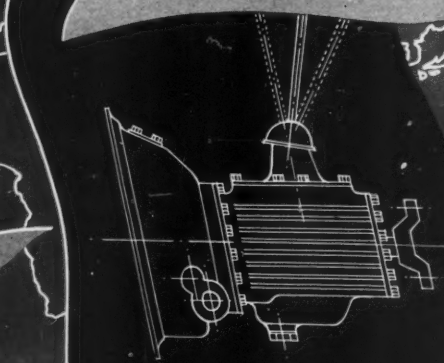
FITZALAN WORKS • SHEFFIELD 9

Telephone: 41188

EXPORT ESSENTIALS

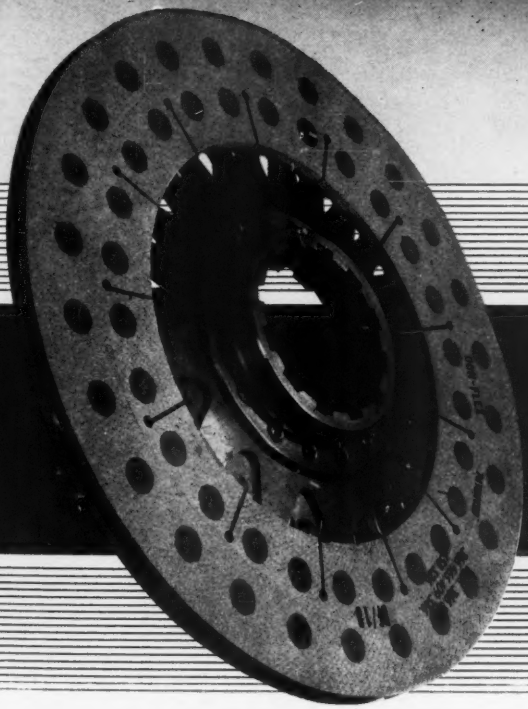
...a rugged engine,





...a robust gearbox,

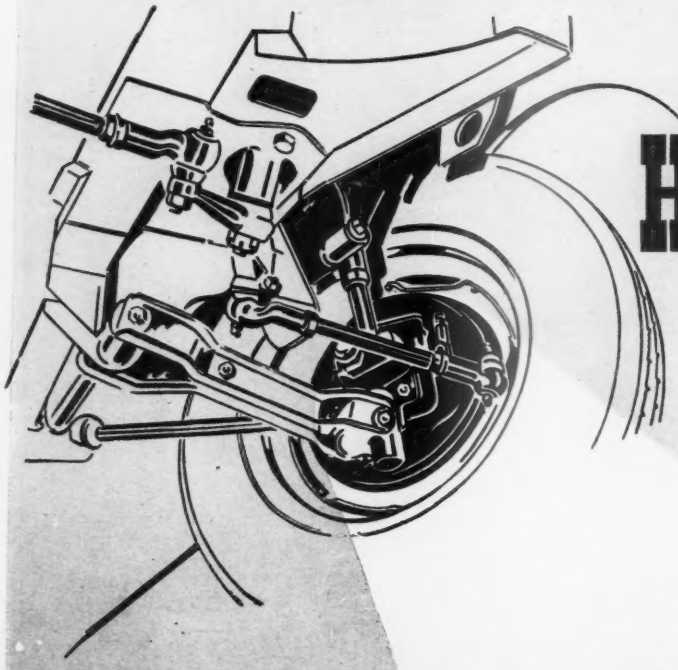
and a clutch disc that can 'take it'...



DON-FLEX

SMALL AND PARKES LIMITED · MANCHESTER · 9
LONDON · 18 HIGH STREET · WIMBLEDON · S·W·19

RB FX38



HOW SAFE!

"CHROMIDIUM" SAFE

Chromidium brake drums are a contribution to the daily effort for greater road safety. A specialised process, exclusive to "Midcyl", ensures even distribution of the graphitic carbon and chromium content, so that variations in surface hardness are avoided and braking is constantly smooth. Distortion is reduced to a minimum in the most exacting conditions while the coefficient of friction is maintained with little variation up to temperatures of 700°F. The absolute minimum of scoring and "pick-up" gives an outstanding economy in braking costs per mile. Chromidium brake drums have been tested, proved and are regularly specified — by some of the largest automobile producers and users in this country.

MIDCYL

THE MIDLAND MOTOR CYLINDER CO. LTD.
BIRMID WORKS · SMETHWICK 40 · STAFFS.

THE BIG

KE 970

This type of 2% Carbon—14% Chrome Tool Steel is recommended for exceedingly high duty work such as the blanking of Hard Steels, Stalloy and kindred laminations in Silicon Iron and for many other tools where high duty and long service are desired. It constitutes probably the greatest advance in tool steel production since the invention of High Speed Steel. After hardening, the temper may be drawn over a much wider range than is permissible with ordinary alloy tool steels.

KE 595

A Super Oil-hardening Tooling Steel eminently suitable for Reamers, Taps, Gauges, End Mills, Broaches, etc. Supplied in the well-annealed and easily machinable condition. Possesses admirable hardenability in thicker sections, combined with minimum distortion and maximum toughness.

KE 672

Known universally as "The Blue Line Die Steel," this Oil-hardening General Tool Room Steel combines excellent hardening properties with good durability, homogeneity, ease of machining and minimum distortion.

KE 637

The perfect Low Temperature, Oil-hardening, Non-shrinking Tool Steel for Ring Gauges, etc., where final grinding is not possible and where minimum distortion is required.

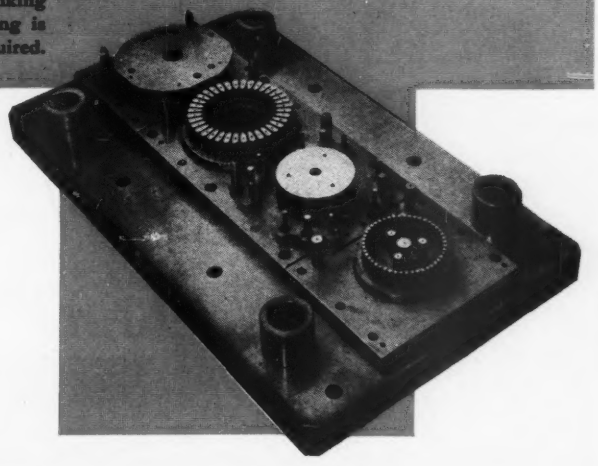


Illustration by courtesy of Hoover Limited

Supplied in the form of hot rolled bars, precision ground bars or as forgings.

LET US HELP YOU WITH YOUR TOOL ROOM PROBLEMS

We also specialise in the manufacture of all types of Precision Ground Steels to the finest limits to meet the needs of modern automatic production.

KAYSER ELLISON & CO. LTD.

CARLISLE STEEL WORKS · SHEFFIELD · ESTABLISHED 1825

LONDON STOCK WAREHOUSE: 4 PEMBRIDGE MEWS, NOTTING HILL GATE, W.11

Telephone : BAYSWATER 7761

pioneer

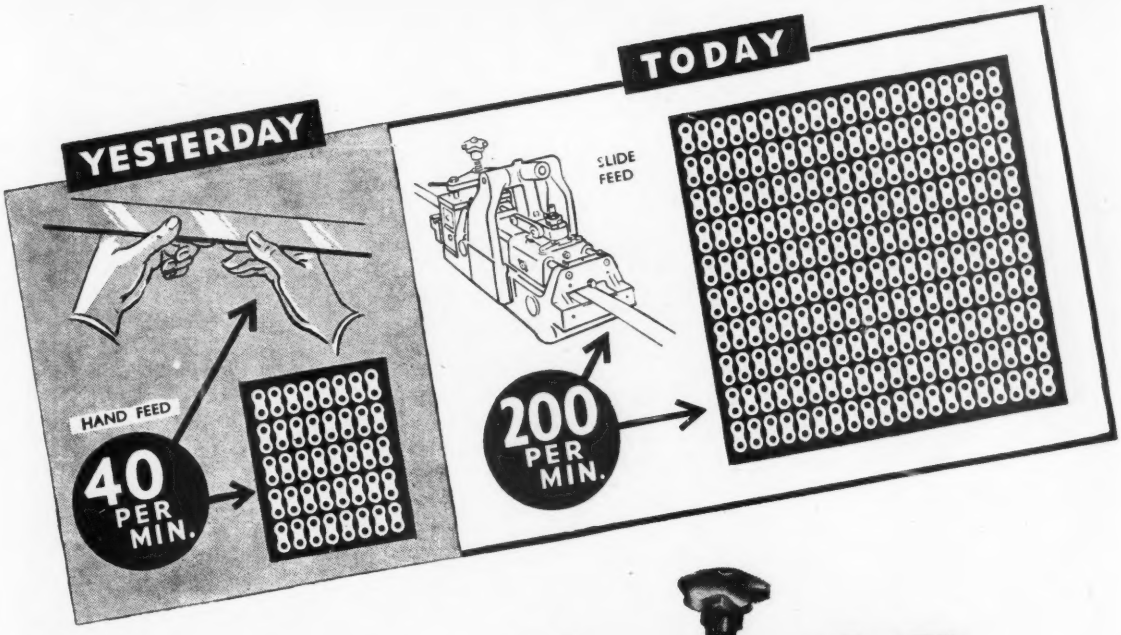
YESTERDAY...

SKF pioneered the first Double Row Self-Aligning Ball Bearing in 1910. Today, with 40 years' research and experience behind them, SKF still lead the way with the most comprehensive range of all four bearing types . . . Ball, Cylindrical Roller, Taper Roller and Spherical Roller

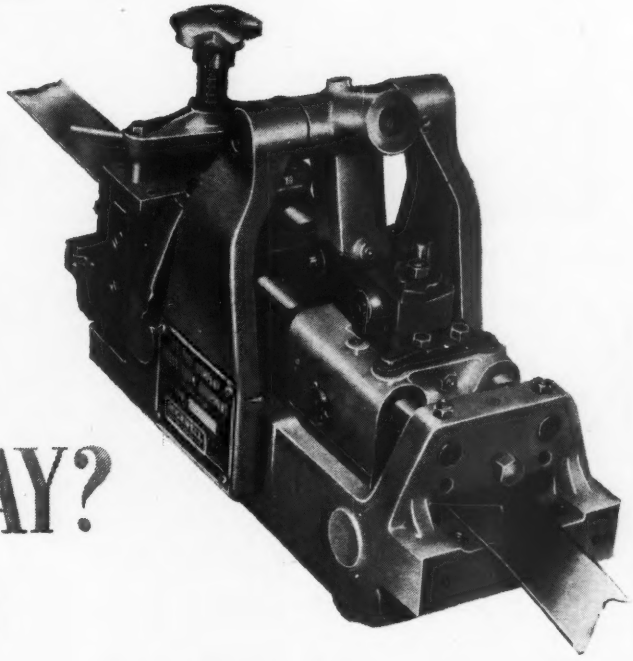
SKF

BALL AND ROLLER BEARINGS

THE SKEFKO BALL BEARING COMPANY LIMITED, LUTON



Where do you fit in . . . TODAY or YESTERDAY?



Yesterday One pair of hands, working very hard,—production 40 pieces per minute. — Slow — costly — dangerous.

Today One U.S. Automatic Precision Slide Feed — production up to 200 pieces per minute. (Using same tool, same press. More important still, one operator runs three machines). Fast — economical -- safe.

BRITISH BUILT U.S. TOOL CO. PRECISION SLIDE FEED

British built U.S. Slide Feeds can be easily fitted to nearly all presses — all drive parts are supplied to suit your requirements.

★ Write now for full details of British built U.S. Tool Company slide feeds; stock straighteners, stock reels and coil cradles.

ROCKWELL
MACHINE TOOL CO. LTD

WELSH HARP, EDGWARE RD., LONDON, N.W.2 'PHONE: GLADSTONE 0033

PR6

DAVID BROWN

AGRICULTURAL & INDUSTRIAL TRACTORS

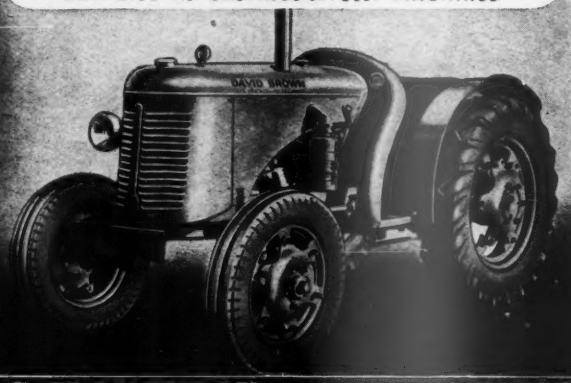
USE

CLANCEY

CAST-IRON

VALVE GUIDES & CHILLED FACED TAPPETS

SUPPLIED AS CASTINGS OR FULLY MACHINED



G·CLANCEY LTD HEAD OFFICE & MACHINE SHOP NEW ST · WEST BROMWICH

FOUNDRY BELLE VALE · HALESOWEN

Formerly CLANCEY & BROWN

KENDALL & GENT

CVM 25

VERTICAL

MILLING MACHINE

POWER
SPEED
ACCURACY
EASE OF CONTROL

make this Machine invaluable for the Aircraft and Automobile industries

KENDALL & GENT LTD

VICTORIA WORKS

GORTON

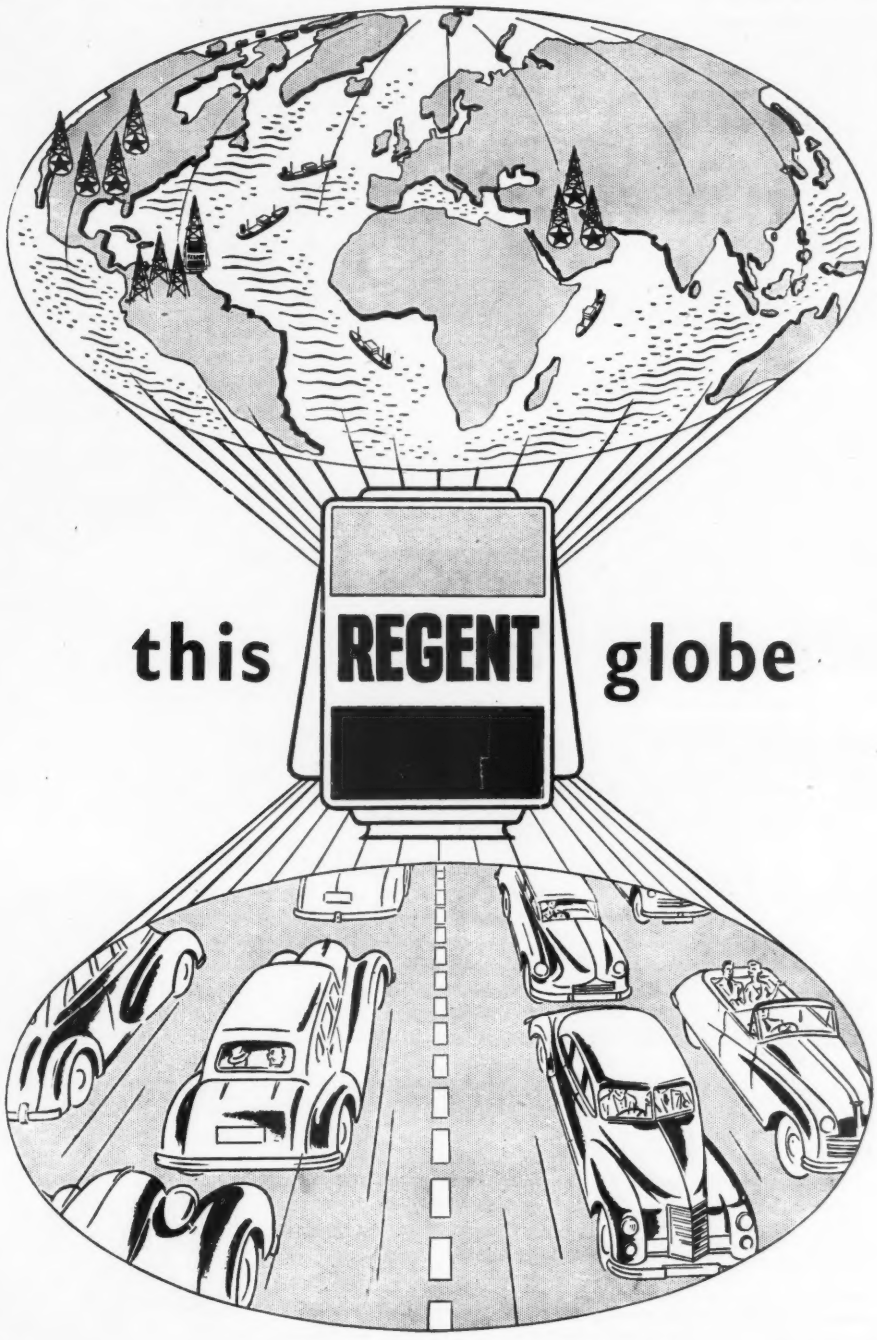
MANCHESTER

67

Telephone **EAST 1035**

K 168

the world of oil behind



this REGENT globe

gives a world of pleasure to Britain's motorists

REGENT OIL COMPANY LTD., 117, Park Street, London, W.1

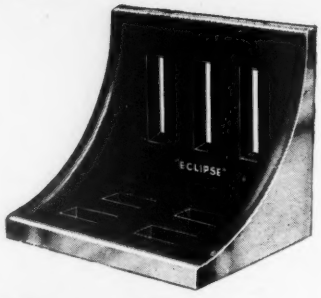
FLAME CLEANING MAKES

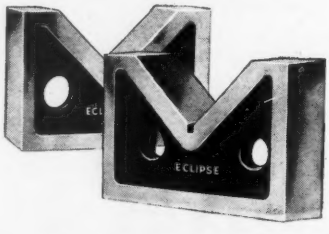
A BIG SCALE CLEAN-UP!

Chipping and wire brushing are slow, laborious ways to remove oxide and scales—and are often unsuccessful. But watch corrosion disappear when Flame Cleaning gets on the job! This B.O.C. process makes short work of the heaviest deposits. Flame Cleaning has a further advantage—it dries out the steel, leaving it in an ideal condition for primming or painting. In these days of shortages Flame Cleaning plays a vital part in conserving valuable material. The illustration shows one of a large number of omnibus wheels given a new—and long—lease of life by Flame Cleaning. For further details of this process write for Booklet T.I.B. No. 11.

THE BRITISH OXYGEN CO LTD LONDON AND BRANCHES

ECLIPSE
the guarantee of quality





the range includes

ANGLE PLATES

made from exceptionally high quality castings, accurately machined square and parallel on outside faces and edges. Supplied in seven sizes.

VEE BLOCKS

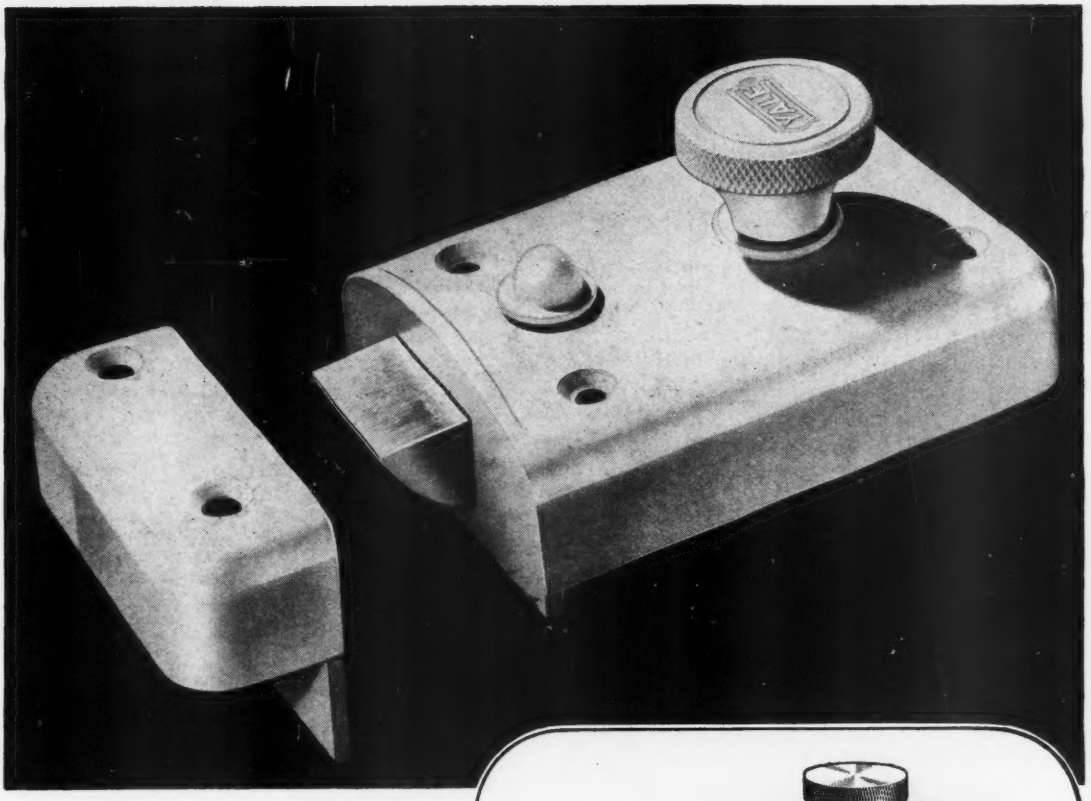
made from exceptionally high quality castings, machined to very fine limits of accuracy to ensure parallelism and squareness of surface and true centreing of the 90° Vee groove. Supplied in matched pairs, packed in strong containers, six sizes being provided.

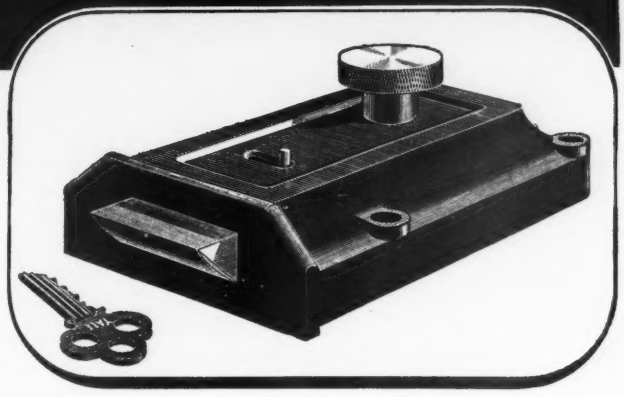
Eclipse TOOLS OF QUALITY

Obtainable immediately from your usual suppliers

MADE BY JAMES NEILL & CO. (SHEFFIELD) LTD.

EG44A





ZINC ALLOY DIE CASTING makes all the difference!

Compare the modern nightlatch shown above with the old model recalled in the small sketch . . . but there *is* no comparison. Not only has the wide adoption of zinc alloy die cast parts resulted in a more pleasing design; it has made available a wider range of attractive finishes; it has eliminated rusting; and it has increased productivity without loss of quality. In addition to the case, staple, turn-knob and slide-knob which are visible, the thimble and deadlocking slides are also die cast in zinc alloy.

Some facts about zinc alloy die casting

Speed of production is an outstanding feature of the die casting process—the shortest distance between raw material and finished product. Zinc alloys are the most widely used of all metals for die casting because they yield castings with the following qualities:

ACCURACY: Castings can be made practically to finished dimensions and need little or no machining.

STRENGTH: Good mechanical properties for stressed components.

STABILITY: Close tolerances are maintained throughout the life of the casting.

British Standard 1004

It is essential that alloys conforming to B.S.1004 should be specified for all applications.

The Association welcomes enquiries about the use of zinc alloy die castings. Publications and a list of Members are available on request.

ZADCA

ZINC ALLOY DIE CASTERS ASSOCIATION

LINCOLN HOUSE, TURL ST., OXFORD

★ DELIVERY EX STOCK

ENGLISH ELECTRIC

overhead busbar system

THE MODERN METHOD OF POWER DISTRIBUTION TO INDIVIDUALLY DRIVEN MACHINE TOOLS

DESIGNED FOR EASY RE-ARRANGEMENT OF MACHINE SHOP LAYOUTS

Write for Publication FG/114A for full details to:—

The ENGLISH ELECTRIC Company Limited

FUSEGEAR WORKS

EAST LANCASHIRE ROAD · LIVERPOOL 10.

Works also at

STAFFORD · PRESTON · RUGBY · BRADFORD

FOUNDERS TO INDUSTRY IN IRON AND STEEL

Track frame stop brackets for the famous Fowler Mark VF British Diesel Crawler Tractor (background). Gear casings for John Holroyd & Co. Ltd. These are just two examples of our contribution to the speed-up of National Production.

CONTINUITY

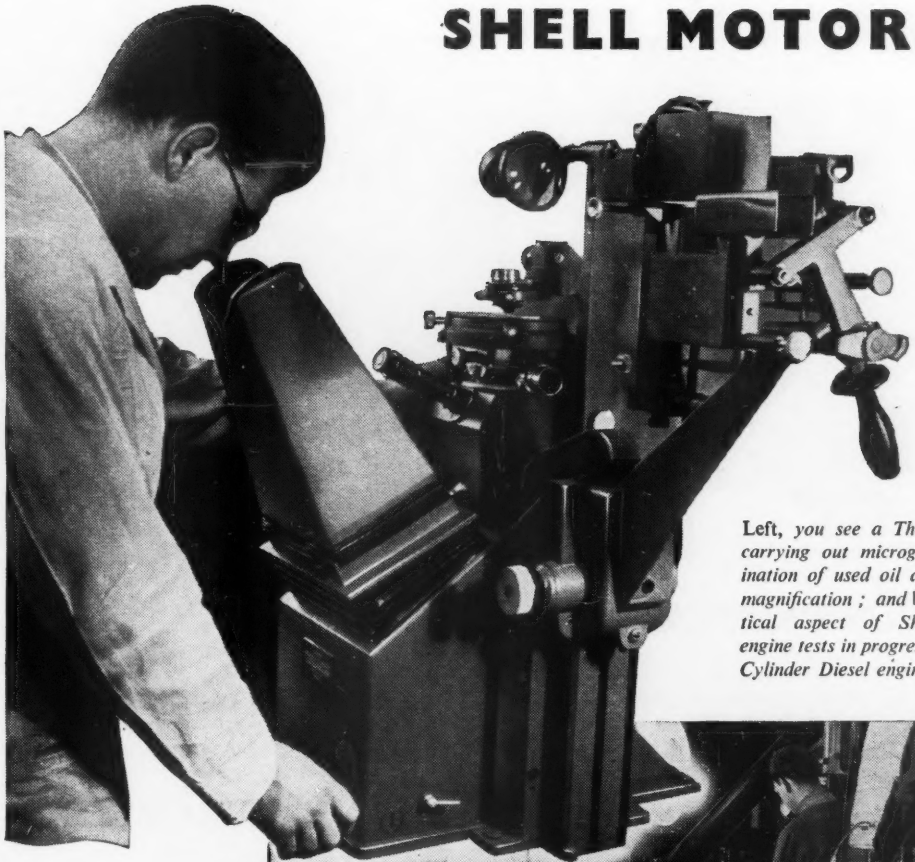
Quality and quantity march together in the modern foundry. Rigid control of every phase of production eliminates trial and error methods, and allows for a very low percentage of scrap on long runs, however intricate the job. Continuity of production gives flexibility and reduces costs. Mechanisation gives speed and strict conformation to the specification. Castings from 1 lb. to 10 cwt. are our business. Write to the Manager:

SPROTBOROUGH FOUNDRY

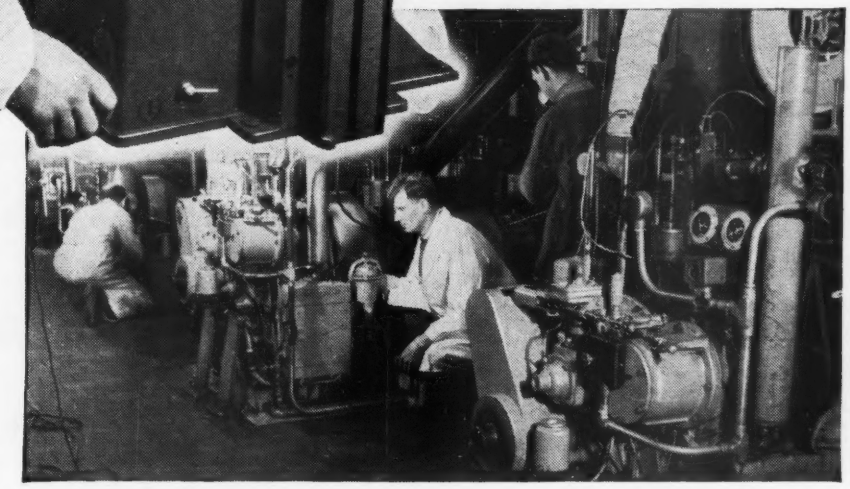
SPROTBOROUGH, Nr. DONCASTER **PHONE No.: 4421**

A PRODUCT OF THE MARSHALL ORGANISATION

SHELL MOTOR OIL



Left, *you see a Thornton scientist carrying out micrographical examination of used oil deposits at high magnification ; and* below, *the practical aspect of Shell research—engine tests in progress in the Single-Cylinder Diesel engine room.*



Different lubricants are needed for different types of engine, whether industrial, marine or automotive. The problem is to produce the one *right* grade for each. The Shell Organisation does just this—working side by side, scientists and technicians are constantly carrying out research. Numerous experimental grades of oil are selected, and then subjected both to exhaustive laboratory tests and to stringent practical tests under actual running conditions. Finally, only those grades are marketed which have been proved *best possible* for their purpose.

The Shell Research Centre, at Thornton, in Cheshire, is the biggest in Britain and one of the best equipped in the world. It is due to the knowledge gained there and at Shell Research Centres in other countries that Shell can today claim their world-wide *leadership in lubrication.* It is not suprising that Motor Manufacturers recommend the use of Shell Motor Oil for their cars.

SHELL

LEADERSHIP IN LUBRICATION

PATENTED

"Honeychrome" process achieves important increase in engine life

Tests prove cylinder bores resist wear 8 times better after treatment

Recently the "Honeychrome" process, developed by Monochrome Ltd., was tested by two well-known manufacturers of internal combustion and Diesel engines. The results shown here provide conclusive proof of the tremendous resistance to wear and increased engine life of "Honeychromed" cylinder bores.

Type of Engine and Liners	Petters Super-scavange Diesel Engines, Wet Liners	B.S.A. 500 cc. S.V. Motor Cycle Engines, Dry Liners
Average rate of wear with untreated Liner	1/1,000" per 1,000 hours	1/1,000" per 3,000 miles with Austenitic Liners
Average rate of wear with Honeychrome Liner. Thickness of deposit .004"	1/8/1,000" per 1,000 hours	4/10/1,000" per 5,000 miles road test Nil to
Average fuel oil consumption with untreated Liner	.372 lbs./B.H.P./Hour	No accurate oil consumption figures available, but an improvement shown with Honeychrome Liners
Average fuel oil consumption with Honeychrome Liner	.364 lbs./B.H.P./Hour	

WHAT THE "HONEYCHROME" PROCESS IS. It is a development of the Monochrome Hard Chromium Plating process which is now being adopted widely for treating particularly such components as cylinders and liner bores, shafts and bearings.
The process consists of a Monochrome deposit in the bore which provides a smooth, regular, non-flaking surface of "dense" chrome. This surface then undergoes a patented treatment which perforates the chrome layer, resulting in a Hard Chrome surface patterned with cellular depressions. These depressions form oil reservoirs for the provision of constant lubrication, and corresponding reduction of wear.

HOW "HONEYCHROME" CAN BE APPLIED TO YOUR PRODUCTS. For Cylindrical bearing surfaces, "Honeychrome" provides the answer to the twin problems of resistance to wear and efficient lubrication. Already engine manufacturers have found that "Honeychroming" makes possible a considerable reduction in weight/power ratio—an important feature in the design of all types of power producing equipment—particularly as it can be applied successfully to aluminium alloys.

THE HONEYCHROME PROCESS

MONOCHROME LTD.
STUDLEY RD., REDDITCH, WORCS.
TEL: STUDLEY 121/2/3/4

WRITE TODAY for full details of how the "Honeychrome" process can give improved efficiency to your products.

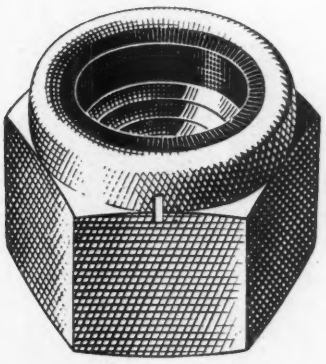
brass extrusions by

McKECHNIE
metal technique

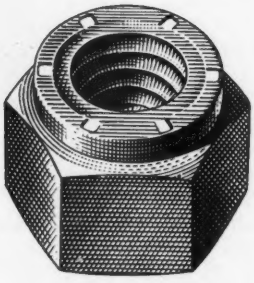
RODS, BARS & SECTIONS

McKECHNIE BROTHERS LTD.,
Metal Works : Rotton Park Street, Birmingham, 16.
Copper Sulphate & Lithopone Works : Widnes, Lancs.
Branch Offices : London, Leeds, Manchester, Newcastle-on-Tyne.
South African Works : McKechnie Brothers S.A. (Pty.) Ltd., P.O. Box 382, Germiston, S.A.

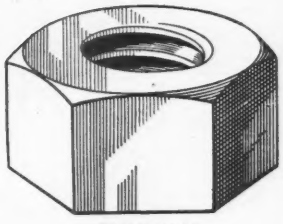
YOU CAN GET THESE APPOINTED STOCKISTS FROM HERE



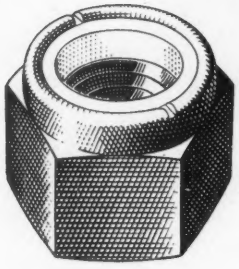
SIMMONDS NUT



PINNACLE NUT



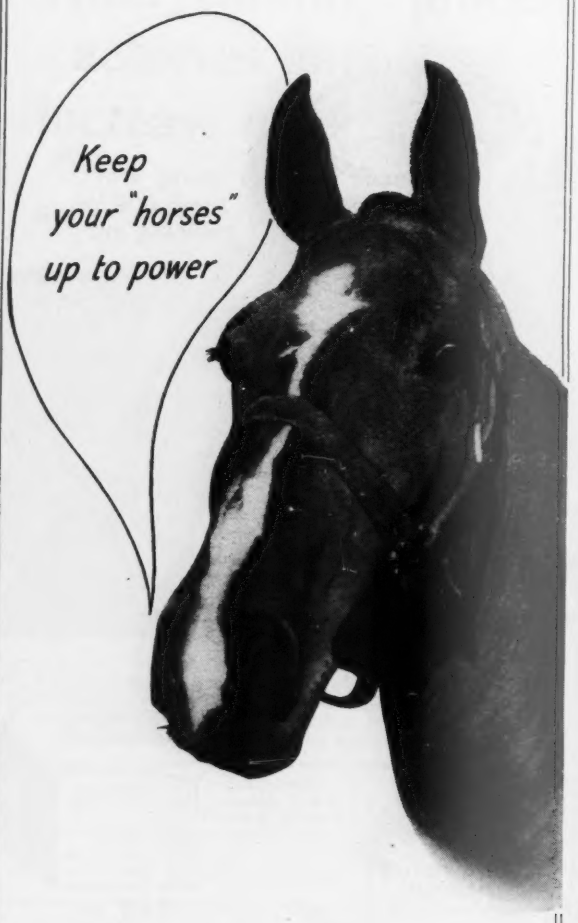
PLAIN NUT



NYLOC NUT

- **J. Beaumont & Son, Ltd.,** 46-54, Trafalgar Street, Newcastle-upon-Tyne, 1.
- **J. A. Challiner & Co., Ltd.,** 79-83, Downing Street, Manchester, 1.
- **H. S. S. Ltd.,** 25, Church Road, Teddington, Middlesex.
- **Hull Factoring Co., Ltd.,** Anlaby Road, Hull, East Yorkshire.
- **Thomas Smith & Co., Ltd.,** 22 & 24, Broad Street, Halifax.
- **John Trelawny & Co.,** Brandon House, 54, Holly Walk, Leamington Spa, Worcestershire.
- **W. H. & G. Walker & Co.,** 11, Edward Street, Parade, Birmingham, 1.

Manufactured by:
SIMMONDS AEROCESSORIES LIMITED · TREFOREST · GLAMORGAN
44G



Your "horses" are always in their prime with CORRUJOINT Gaskets. All metal for long life, even thickness for equal compression, CORRUJOINT give thoroughbred efficiency and reliability.

CORRUJOINT
ALL METAL
FOR EVERY ENGINE

THE CORRUGATED PACKING & SHEET METAL CO., LTD.
GATESHEAD-ON-TYNE

Tel: Gateshead 71785 Grams : Corrujoint Gateshead

PROBLEMS ARE OUR BUSINESS

The more difficult the job the more we enjoy it — as specialists we have all the attributes of long experience — mature judgment, accurate foresight, wise interpretation. There is nothing that pleases us more than a chance to tackle those "impossible" pressings.

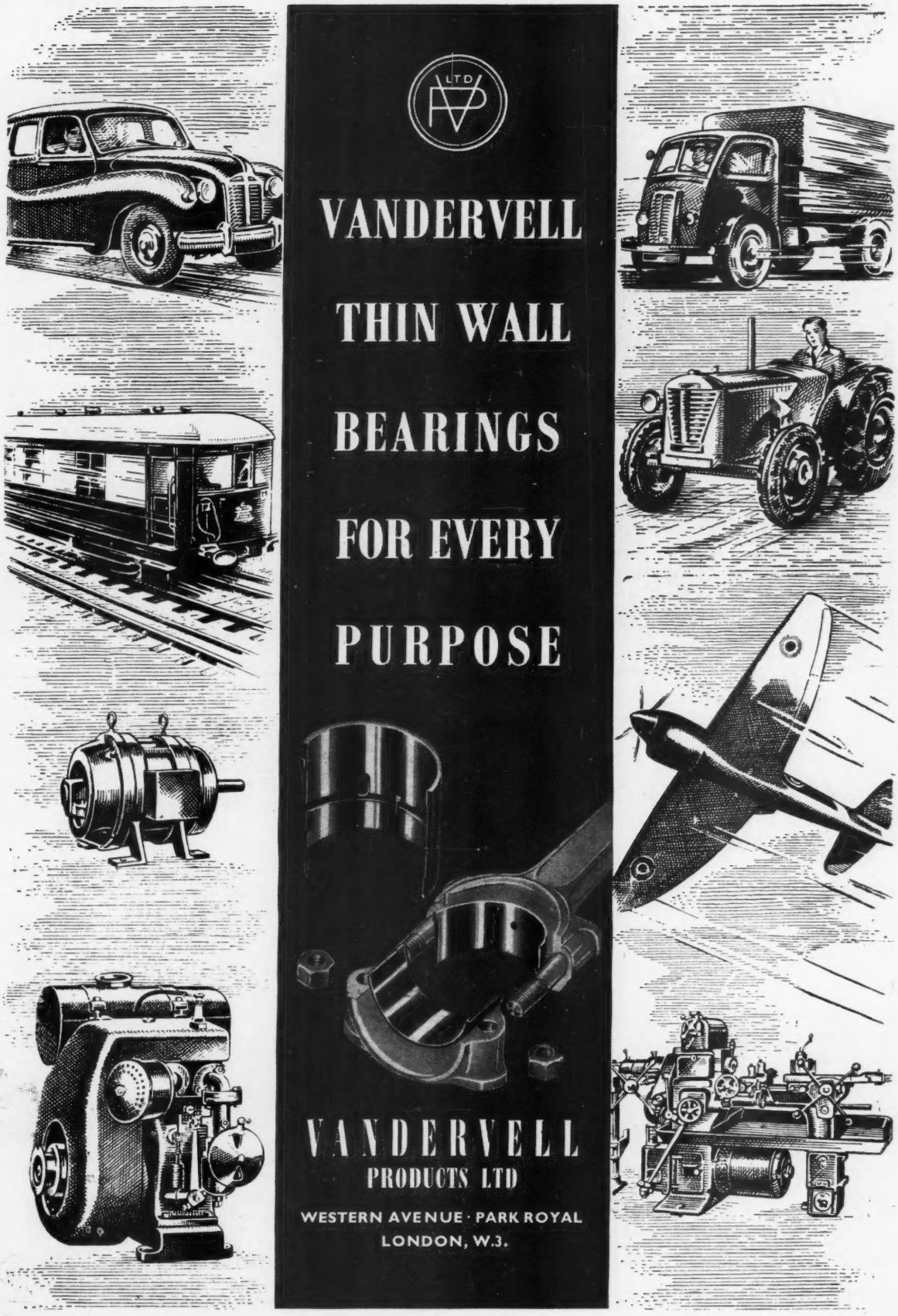
Hassett & Harper Ltd
On M.O.S., M.A.P. and ADMIRALTY Lists
REGENT PLACE · BIRMINGHAM · 1

5341A

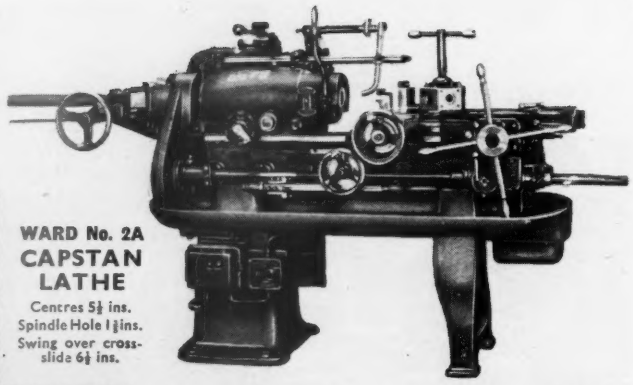
HANDS WANTED!

WHAT kind of hands? Skilled hands—nimble hands—above all, healthy hands. Keep a special watch on those processes in which soluble, cutting and fuel oils, degreasers and solvents may result in dermatitis — that means hands that are lost to production. Where Rozalex barrier preparation is used, output is never endangered by dermatitis, or by the fear of dermatitis, which can be almost as crippling. Rozalex is simple to apply, and forgotten by the user when applied. There is a type of Rozalex to act as a barrier against almost every known industrial irritant. Our technical representative is at your service. Write to Rozalex Ltd., 10 Norfolk Street, Manchester 2.

APPLY ROZALEX


LTD
VANDERVELL
THIN WALL
BEARINGS
FOR EVERY
PURPOSE
VANDERVELL
PRODUCTS LTD
WESTERN AVENUE · PARK ROYAL
LONDON, W.3.

For MAXIMUM Production



WARD No. 2A CAPSTAN LATHE
Centres 5½ ins.
Spindle Hole 1⅛ ins.
Swing over cross-slide 6½ ins.

Ward CAPSTAN AND TURRET LATHES

Messrs. S. Wolf & Co. Ltd., Pioneer Works, Hanger Lane, London, W.5, use the Ward No. 2A Capstan Lathe for producing, among other parts, the intermediate pinions of their well-known electric portable drills. The work, which is centred, turned, undercut and chamfered, is 1" dia. × 3½" long in annealed steel BSS EN24.

H.W. WARD & CO. LTD
SELLY OAK BIRMINGHAM 29
TELEPHONE SELLY OAK 1131

W533

AMAL

THE SOCIETY OF MOTOR MANUFACTURERS & TRADERS LTD

Component Specialists to the Motor Industry

AMAL LTD · HOLFORD WORKS · BIRMINGHAM 20

A complete range of socket sets for all servicing purposes made in British, American and Metric sizes

Please write for details of sockets, handles and parts, wrenches and extractors.

JENKS BROTHERS LIMITED
Bushbury - Wolverhampton

CHROME ALLOY STEEL BRITOOL SERVICE TOOLS

G109K

A CROP THAT TOOK 228 YEARS TO PERFECT

LLOYDS DUCTILE IRON

Unique crops of Iron castings are being harvested down Burton way. Castings that have been wishful thinking for over two centuries have suddenly become reality. For Lloyds of Burton are now casting in Ductile Iron, the wonderful new ferrous metal that has taken nearly 228 years to perfect.

Ductile Iron can be twisted like steel. It has a tensile strength of 30/40 *tons per square inch with elongation up to* 15% *and over. It is shock resistant, fluid and readily machineable.*

Its field of application is immense and includes castings ranging from Dies to Machine tools; furnace parts to clutch plates, and shake out hammers to pressure castings for valves and pumps. Illustrated is a tractor support cast in Ductile Iron.

LLOYDS HIGH DUTY IRONS

LLOYDS (BURTON) LTD BURTON ON TRENT TELEPHONE BURTON 3867

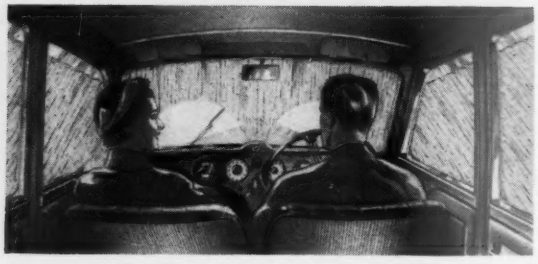
Packed with EXPERIENCE-

—the experience of many years of welding in our own shops

THE ELECTRODES WE SELL ARE THE ELECTRODES WE USE

METROPOLITAN-VICKERS ELECTRICAL CO. LTD., MANCHESTER, 17, ENGLAND.

Member of the A.E.I. group of companies.



It can rain cats and dogs for all they care!

They need not fear the risk of getting wet on a stormy day, for all the windows and window frames are perfectly sealed with "AUTOPAC" Glazing and Bedding Compound—the best insurance against the ravages of climate and weather conditions.

Most famous car and commercial vehicle manufacturers use this tried and trusted "APAC" product. Follow the lead of those in the know and INVEST in

AUTOPAC

Glazing and Bedding Compound

ALLIED PAINT & CHEMICALS LTD., TYSELEY, BIRMINGHAM 11

Telephone: ACOcks Green 2233/5

A range of special purpose steels designed for widely differing industrial applications

The new Edition of the Dunelt Steels Catalogue, listing qualities, tests, treatments and analyses of the complete general range of Dunelt high quality special purpose steels will be sent on request.

Dunelt

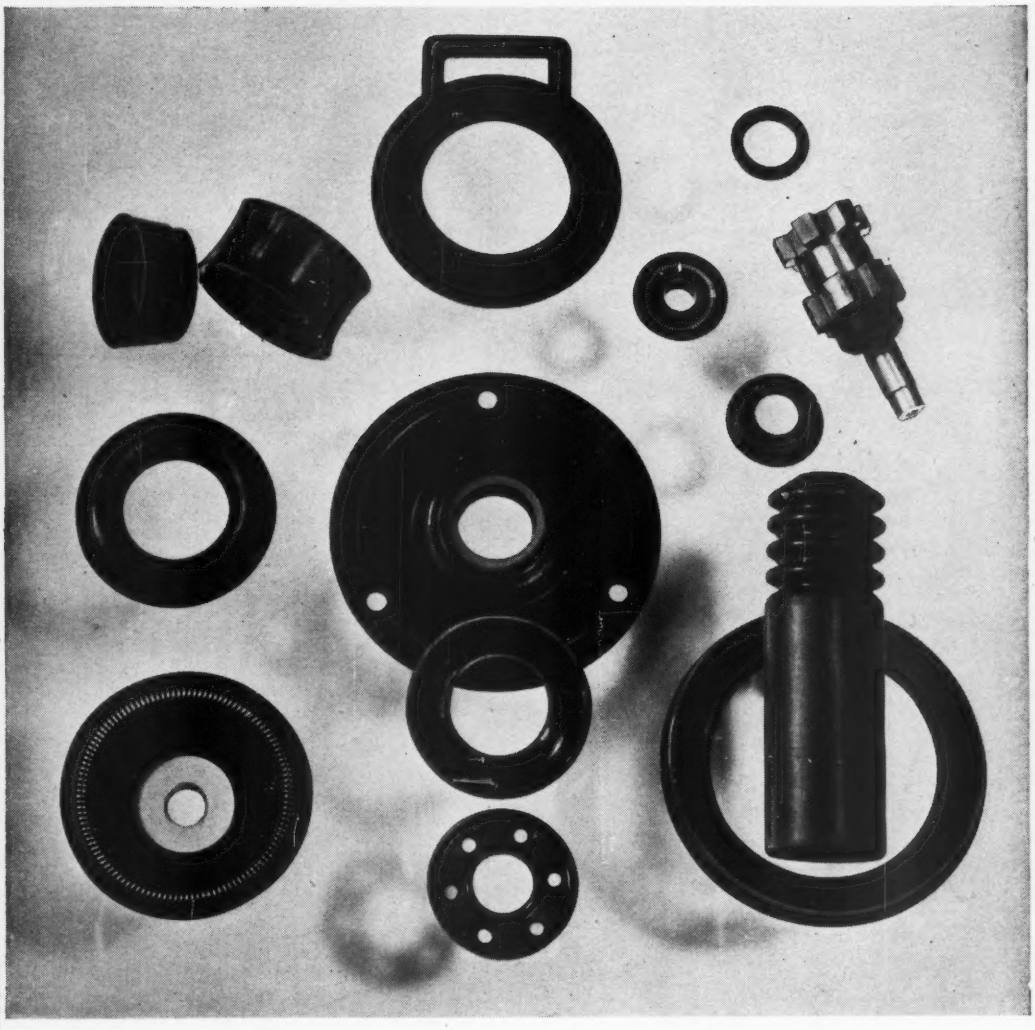
STAINLESS STEEL
ALLOY STEEL
HEAT RESISTING STEELS
HOLLOW STEEL BARS

DUNFORD & ELLIOTT (SHEFFIELD) LTD.
ATTERCLIFFE WHARF WORKS, SHEFFIELD, 9
London Office: 54, Victoria Street, S.W.1
Birmingham Office: 25, Burlington Chambers, 118, New Street.

GACO
REGD TRADE MARK

Hydraulic Packings

AND FLUID SEALING COMPONENTS



"Gaco" is *ideal* for hydraulic sealing. It is grainless, resilient, non-porous, highly resistant to Oils, Fuels and Solvents, and has excellent wearing properties. "Gaco" mouldings are produced in a great variety of shapes and hardnesses and are well-known for their superior surface finish and dimensional accuracy.

We shall be pleased to give you the benefit of our wide experience in the solution of your fluid sealing problems.

ANGUS OIL SEALS
Fluid Sealing Engineers.

★

GEORGE ANGUS & Co LTD
OIL SEAL WORKS,
NEWCASTLE UPON TYNE, 6.

'Phone: 56161. Grams: "GACO" Newcastle

Encourage your staff to save a little every pay day

a good saver is a good worker

Starting a Staff Savings Group is a simple process. All the information, equipment and publicity material you require will be gladly sent free of charge on application to your Local Savings Committee or to the National Savings Committee, 1-5 Prince's Gate, London, S.W.7.

Issued by the National Savings Committee

Made to measure

This isn't just a spring. It is 'the' spring. It is the best spring in the world—to do the job it was designed for. There is just one such for every job, and it is part of the Lewis service to find it for you. Ask us about your next project.

Makers of high quality springs for 30 years. A.I.D. approved.

LEAVE IT TO **Lewis** *OF REDDITCH*

Telephone: Redditch 720/1/2

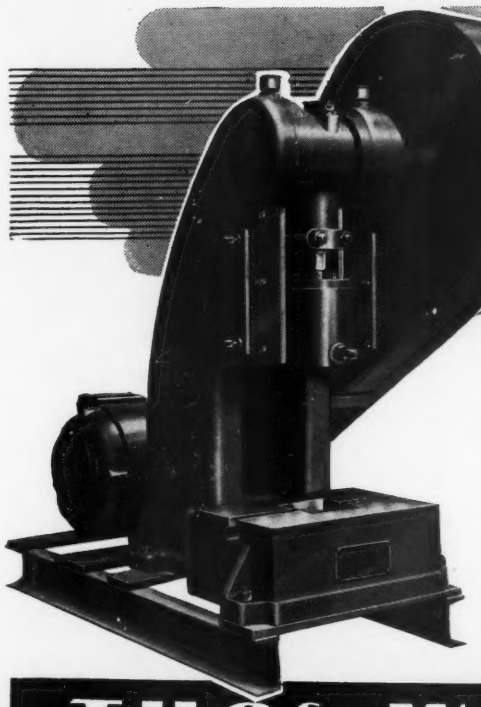
THE LEWIS SPRING CO. LTD.
RESILIENT WORKS, REDDITCH
London Office: 322 HIGH HOLBORN, W.C.1.
Telephone: HOLborn 7479 & 7470.

Recording ACCELEROMETER

Devised mainly for the testing of road vehicles either in experimental stages, in production or after repair work. By recording on a paper strip on an accurate time base the various accelerations which are obtained in increasing speed, braking or cornering, or in assessing the effectiveness of vehicle suspension, the instrument has a wide range of usefulness. In addition, it can be used for measuring vibrations of low-frequency and other motions which occur in ships aircraft, machines and structures.

DOBBIE-McINNES

DOBBIE McINNES LTD
Nautical & Engineering Instruments
BROOMLOAN RD. GLASGOW SW1
Also at SOUTH SHIELDS · LIVERPOOL · LONDON



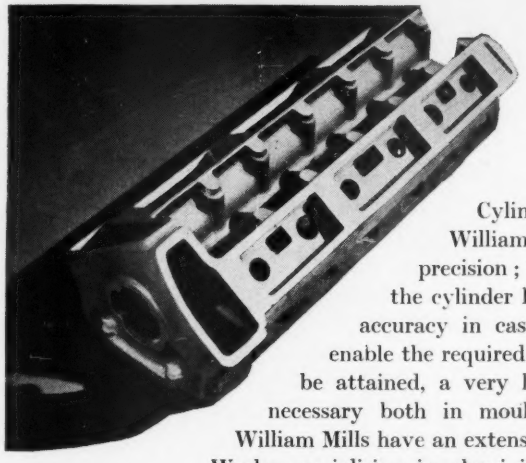
BENCH POWER PRESSES

These Bench Power Presses are designed to provide the perfect alternative to the smaller types of hand presses. They are compact, easy to operate, and of very sturdy construction.

Where desired a motor drive can be supplied either for mounting as shown or on a common base-plate so arranged that the machine can be fed either across the bed or from front to back.

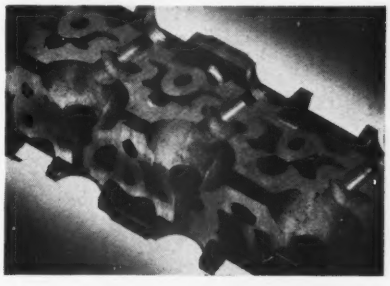
2, 3 and 6 ton models available—full specifications on request.

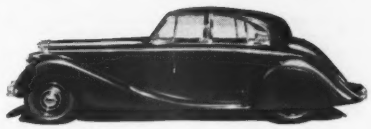
THOS. W. WARD LTD
ALBION WORKS · SHEFFIELD
TELEPHONE 26311 (15 LINES) · TELEGRAMS 'FORWARD' SHEFFIELD
LONDON OFFICE: BRETTENHAM HOUSE · LANCASTER PLACE · STRAND · W.C.2



our part of the performance

Cylinder heads for the high performance Jaguar car are made by William Mills. These aluminium alloy castings are fine examples of precision ; 24 cores, many of them of the most intricate form, are used in the cylinder head. To obtain great accuracy in casting section and thus enable the required engine performance to be attained, a very high degree of skill is necessary both in moulding and coring up. William Mills have an extensive, highly mechanised Works specialising in aluminium alloy castings and backed by the most up-to-date laboratory control. For technical advice. on design and application please consult our Technical Sales Department.





The Jaguar Saloon on 2½ and 3½ litre chassis
Photo ; Courtesy Jaguar Cars Ltd., Coventry

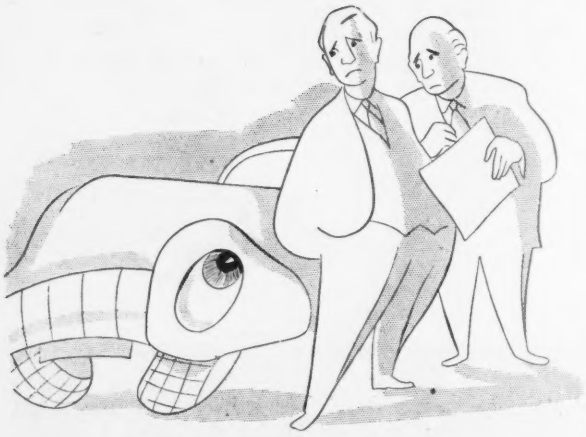
William Mills Ltd

Specialists for Fifty Years in

ALUMINIUM ALLOY CASTINGS

WILLIAM MILLS LIMITED, FRIAR PARK FOUNDRY, FRIAR PARK ROAD, WEDNESBURY, STAFFS.

We should worry-

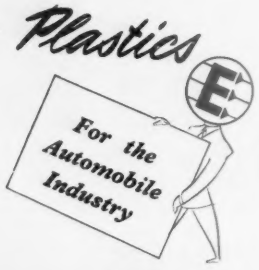


-why should you ?

BRITAIN'S motor industry is too busy to worry about mouldings when there is a service like Ekco Plastics to produce anything from a gear-lever knob to an instrument panel. Ekco estimate, design, tool and press for any known moulding requirement—with the inclusion of metal inserts, turnings and wiring where necessary —and ensure that deliveries keep pace with production programmes. They do all the worrying. You merely ask for supplies—and get them !

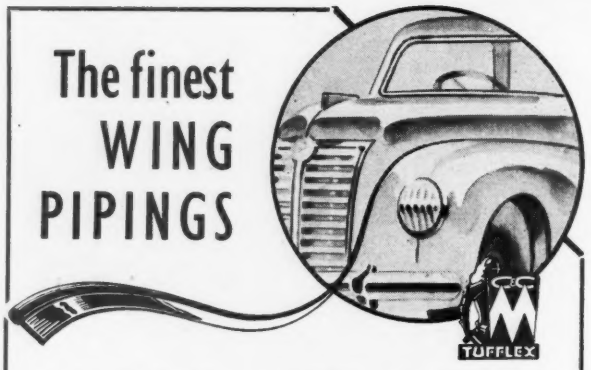
EKCO *Plastics*

Consult EKCO Plastic Advisory Service on any moulding problem. You have only to telephone SOUTHEND 49491



E. K. COLE LTD., (Plastics Division) SOUTHEND-ON-SEA

The finest WING PIPINGS



P.V.C. Wing Pipings, as supplied to leading motor manufacturers and body builders at home and abroad have proved that plastic materials survive the severest tests.

Whether as standard fittings used as wheel arch pipings or specially designed joint mouldings, our sections are guaranteed to meet your particular requirements.

Your enquiries are welcomed and our technical staff are always at your service.

EXTRUSIONS ARE OUR BUSINESS— NOT JUST A DEPARTMENT

C. & C. MARSHALL LTD.

PLASTRIP HOUSE
OAKLEIGH ROAD NORTH, LONDON, N.20

Telephone: Hillside 5041 (3 lines). Telegrams: Tufflex, Norfinch, London. Cables: Tufflex, London.

MASS PRODUCTION PRESSWORK

Our service excels in rapid, accurate methods either for mass production or work in small batches. We can make tools where required.

We cover all machining operations and also undertake welded work combined with presswork.

GIRDEX ENGINEERING COMPANY LIMITED

WESTON LANE, TYSELEY, BIRMINGHAM, 11

Telephone : ACOcks Green 2205. *Telegrams : GIRDEXPRES*

G. 30.

INTAL

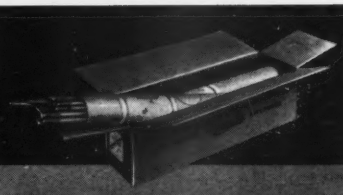
That's the DRILL... And This is the TAP..

Attractively Packed

Immediate delivery of standard sizes and many specials

THE INTERNATIONAL TWIST DRILL COMPANY LTD
WATERY STREET • SHEFFIELD. 3. • PHONE 23072-3-4

Quasi-Arc REG. TRADE MARK INTRODUCE



NEW TYPE RADIAN

ELECTRODES FOR WELDING MILD STEEL

Since **Radian** was introduced five years ago it has become the most popular mild steel electrode in Great Britain.

Now Quasi-Arc have made **Radian** easier for the welder to use, whilst retaining the quality of the deposit.

FIVE SPECIAL FEATURES OF NEW TYPE **RADIAN**

- (1) Smoother Running.
- (2) Easier deslagging.
- (3) Freedom from fumes.
- (4) Weldmetal quality of the well-known **Radian** standard.
- (5) Approved by Admiralty, Lloyds united with the British Corporation Register of Shipping and Aircraft and the Ministry of Transport.

Quasi-Arc REG. TRADE MARK WELDING SERVICE TO INDUSTRY

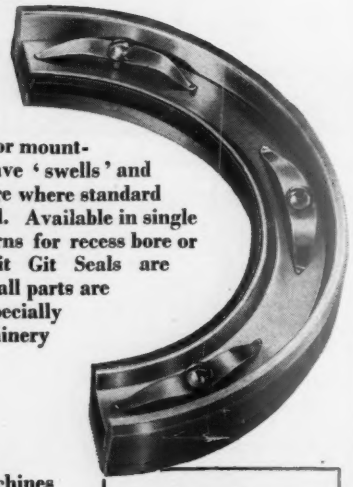
THE QUASI-ARC COMPANY LTD., BILSTON, STAFFORDSHIRE.

Phone: BILSTON 41905 (6 lines).

MANUFACTURERS OF ARC WELDING ELECTRODES, PLANT AND ACCESSORIES

SPLIT GIT SEALS

GET OVER THE AWKWARD CORNERS



Weston Split Git Seals are specially designed for mounting on shafts which have 'swells' and flanges, in fact anywhere where standard oil seals cannot be fitted. Available in single and dual sealing patterns for recess bore or flange mounting. Split Git Seals are absolutely oil tight and all parts are renewable. They are specially suitable for heavy machinery such as :—

- Rolling Mills
- Furnace Charging Machines
- Cranes
- Calanders
- Crushers
- Drying Cylinders
- Gear Reduction Units
- Winches.

Our technical department will be happy to assist you in every way they can, advising you on all problems concerning the use of Split Git Seals.

WESTON

Oil Seals

CHARLES WESTON & CO. LTD., Irwell Bank Works, Douglas Green, Salford 6. Telephone : Pendleton 2857-8-9. Birmingham : Mid. 6952. London : Hol. 0414.

W.62

CASTINGS

The technique of modern Pressure Die Casting enables work of an intricate nature to be reproduced with an accuracy equal to that of best workshop practice, but at a saving in time, labour and "spoils" that invites your earnest investigation. Among examples we show here a FHP geared motor in which the carcase, end plates and gear case are pressure die cast in Zinc Base Alloy within an exacting tolerance specification and at a rate of several hundreds daily. May we explain how we can serve your needs also ?

H. J. THORMANN ENGINEERING COMPANY LTD
5, ELSTREE WAY, BOREHAM WOOD, HERTS
Telephone ELSTREE 1382-3-4 *Cables* THORMANN, PHONE, LONDON

STEEL WORKSHOP TOOL LOCKERS
Stop Losses

When each operator has one of these handy lockers, there is an end to tool losses. Time-wasting searches, and bad feeling are also checked, and everyone has an inducement to safeguard their belongings. Complete with padlock.

CASHMORES

JOHN CASHMORE LIMITED
Great Bridge, Tipton, Staffs.
Telephone: Tipton 2181 (5 lines Also at **NEWPORT, MON.** *Tel.: Newport 3944 (4 lines).*

Size: **35½" High**
18" Wide
18" Deep
Colour: **Green**

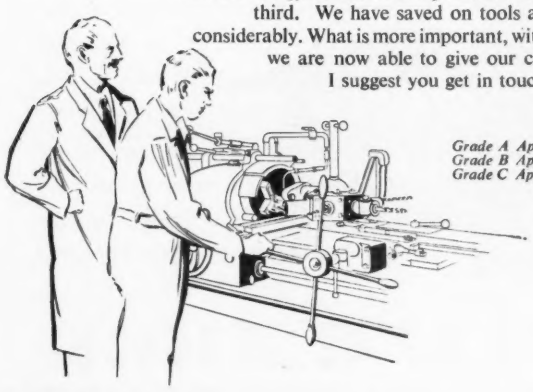
PRICE
50/-
EACH

Carriage Extra.
Cash with order.

dm CE74

"It will mean a saving of 30% on machining time with 'Telfos'"

"It has been proved over and over again. For years we used ordinary Rolled Phosphor Bronze on this job—then we heard about 'Telfos' Bronze and learned that it was a similar metal. Our technical people soon satisfied themselves about chemical composition, physical properties and so on and it wasn't long before we changed over. Since then our output of these components has increased by nearly one third. We have saved on tools and reduced our production costs considerably. What is more important, with our increased production, we are now able to give our customer the quantities he requires. I suggest you get in touch with Cliffords."



Grade A App. 95% Copper, 5% Tin, ·1% Phos.
Grade B App. 92% Copper, 8% Tin, ·1% Phos.
Grade C App. 90% Copper, 10% Tin, ·1% Phos.

Chas. Clifford Birmingham

TELFOS BRONZE
REG. TRADE MARK
Free Machining Wrought Alloys

RODS AND BARS
ROUND, SQUARE, FLAT AND HEXAGON

Write for descriptive folder to the makers
CHARLES CLIFFORD & SON LTD., DOG POOL MILLS, BIRMINGHAM 30 *Offices : London, Glasgow, Manchester and Dublin*

Specialists in
NICKEL *and* NICKEL ALLOYS
for every industry

"NICHROME"

BRITISH DRIVER-HARRIS CO. LTD.
GAYTHORN MILL, ALBION ST., MANCHESTER 15
ALSO AT LONDON AND BIRMINGHAM

GKN 18-8

THE NUMBER THAT BEATS RUST

If you want steel fastenings that are proof against practically all corrosive conditions—think of the number *18-8*. 18-8 means stainless steel with 18% chromium and 8% nickel... far and away more economical in performance than slightly cheaper stainless steel products which lack 18-8's high rust-resisting quality. It's not enough to say "stainless"... remember the perfect combination... say G.K.N. *18-8*. We will be glad to supply full details of 18-8 stainless steel screws, bolts, nuts, cotter pins, hooks, self tapping screws etc. Our stock ranges are being considerably expanded and are the most comprehensive in the industry.

GKN **GUEST KEEN & NETTLEFOLDS (MIDLANDS) LIMITED**

SCREW DIVISION: BOX 24, HEATH STREET, BIRMINGHAM, 18 S/18-8/3003

DISMANTLING !
REPAIRING !
OVERHAULING !

That's the Time You Cuss the RUST

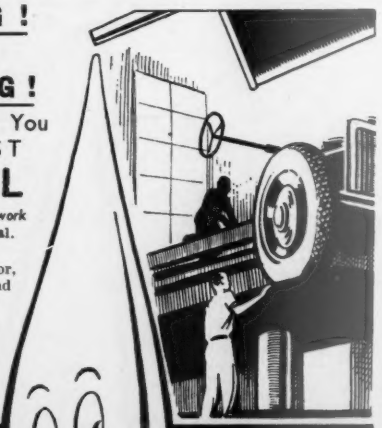
USE **LUSOL**

Harmless to Hands and Woodwork

In ½ Pt., Pt., Qt., ¼ Gal., Gal. and 5 Gal. Drums.

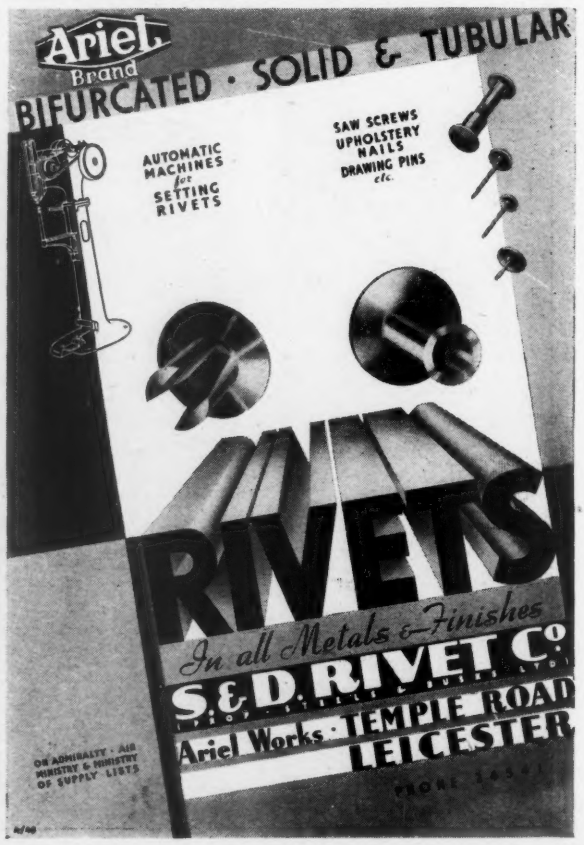
Obtainable from your Factor, Wholesaler, Ironmonger and Hardware Merchant. In case of difficulty write the manufacturers.

The Great Eastern Oil Co., Ltd., Dept. 26, 372 Scotland Street, Glasgow, C.5.

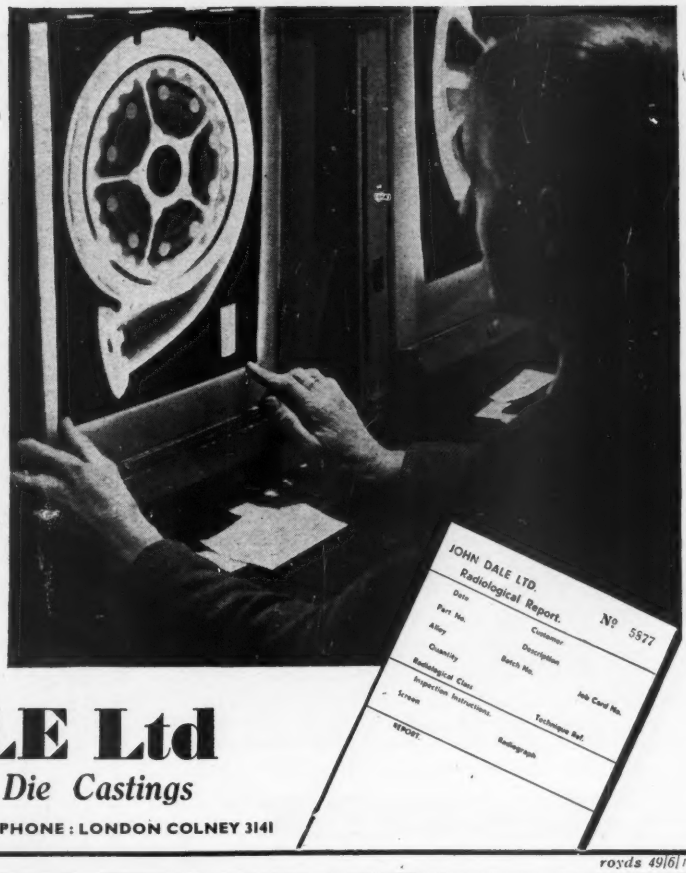


BUST THE RUST WITH LUSOL

REGD.



A perfect Casting...



An aircraft casting, used for pumping inflammable liquids, must be leak-proof. The X-ray shows that this high strength aluminium alloy casting is free from porosity. Having examined the X-ray, the John Dale Radiologist will then fill in Radiological Report No. 5877. A high number? Yes—because X-ray inspections are an every day occurrence at London Colney. So is flawless casting.

JOHN DALE Ltd

Tested Aluminium Alloy Die Castings

DEPT. (T.S.3), LONDON COLNEY, HERTFORDSHIRE. TELEPHONE : LONDON COLNEY 3141

royds 49/61

MAGNETIC CHUCKS FOR ALL PURPOSES

For nearly fifty years we have specialised in the design and manufacture of magnetic chucks and demagnetizers, during which time we have produced the largest chucks in the world.

Rectangular and circular chucks are available in standard sizes, or built to your own individual requirements.

A World Wide Service IN MAGNETIC CHUCKS

J. H. HUMPHREYS & SONS
BLACKRIDING ELECTRICAL WORKS
WERNETH : OLDHAM
Phone : MAIn 1651

● *Our catalogue describes fully the specialised service we offer. Send for a copy to-day and tell us of your own particular problem—we shall be pleased to advise you.*

'GOOD MIXERS' SAY OUR ENGINEER FRIENDS

Where soluble cutting oils are concerned, this is indeed a compliment. Those bearing the F.M. mark always mix easily and are stable in use. Moreover, they are specialised for broad classifications of tooling—this helps selection. Over the years, we have developed many unique formulae, giving better service at very low cost per gallon of emulsion. You will find all Fletcher Miller soluble oils fully described in our brochure "Cutting Fluids"—ask for your copy.

—and here they are

ALUMEDGE

Provides better coolant control when machining high tensile aluminium alloys because it has exceptional metallic affinity. In all tapped and screwed work, this oil produces clean, accurate threads. Renders the use of paraffin unnecessary.

CLEAREDGE

This blend gives a comparatively translucent emulsion with high performance. Unlike some types of clear coolant, it is non-gumming and the mixture does not weaken in use. Specially valuable for machining of marked-out work in the toolroom.

IRONEDGE

This non-fatty coolant resists the disintegrating effect of cast-iron or zinc alloys on soluble oil emulsions. Is definitely preferable to machining dry on account of the surface finish provided.

FILEDGE

Possesses a low fat content thus yielding a fine molecular dispersion with water, ideal for all grinding work where soluble media are suitable. Permits finer grits to be operated and obviates any trace of wheel glazing.

COOLEDGE

Probably the most versatile soluble oil in production, COOLEDGE provides a rich emulsion of marked stability and long life. It is thus able to service a wide range of machining operations and when used in a fairly concentrated state (1:10) can often replace the more expensive straight oils. Operatives like its clean odour and complete freedom from welfare risks. It is very suitable for coolant standardisation throughout general machine shops.

Cutting Fluids by FLETCHER MILLER LTD

HEAD OFFICE & WORKS:
ALMA MILLS, HYDE, Near MANCHESTER
Phone: HYDE 781 Grams: EMULSION, HYDE

BRANCH WORKS:
SILVERDALE ROAD, HAYES, MIDDLESEX.
BILHAY STREET, WEST BROMWICH.
and GLASGOW.

CF 9.

Collier's
HOSE CLIP
The Most Positive Worm Drive
The slots are pierced right through the band, thus affording the worm or screw an absolutely certain grip under all conditions.

WHY the transport industry prefers FENNER V-BELT DRIVES

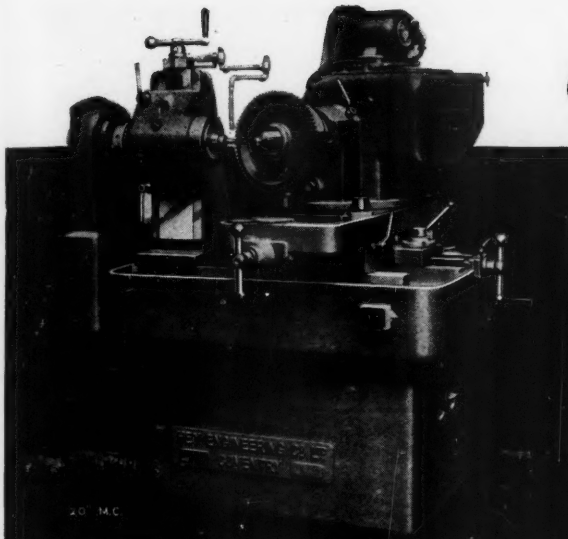
NEW FACTORY
Recently completed at Hull with modern machinery and highly skilled staff backed by 20 years' experience in the manufacture of V-Belt Drives.

IMMEDIATE DELIVERY
Standard V-Belts and Pulleys for drives up to 30 h.p. carried in stock at each branch.

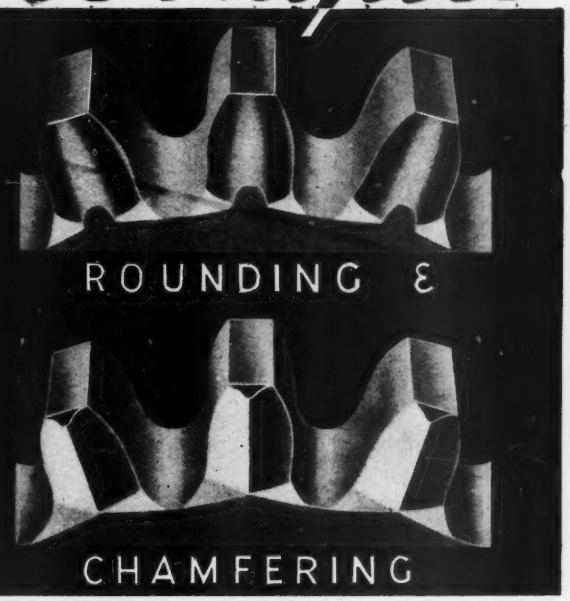
TECHNICAL ASSISTANCE
Experienced Engineers available for design and application of drives supported by research and testing facilities.

J. H. FENNER & CO. LTD.

BELFAST · BIRMINGHAM · CARDIFF · COLNE · GLASGOW · HULL
LIVERPOOL · LONDON · MANCHESTER · NEWCASTLE · NOTTINGHAM
SHEFFIELD · CLECKHEATON (YORKS)



For Rapid



HEY ENGINEERING CO. LTD. COVENTRY

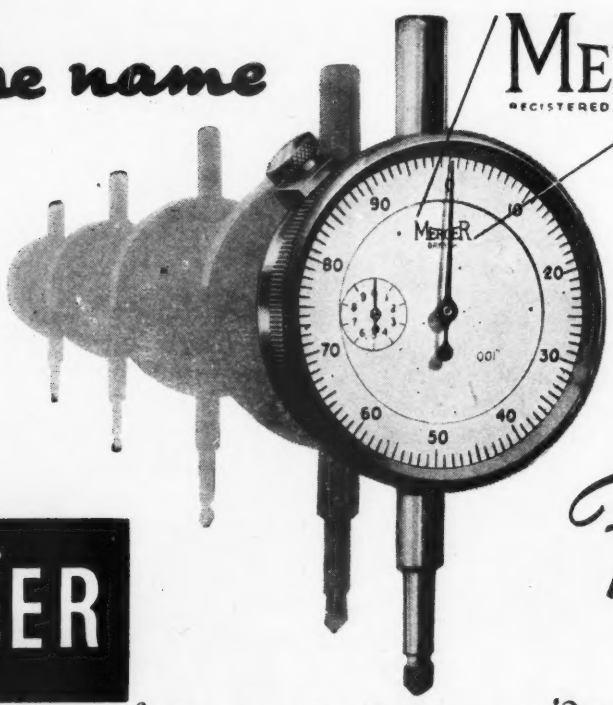
PHONE. COVENTRY 88641

ROTARY CAM AND PROFILE MILLING MACHINE • SHORT THREAD MILLING MACHINES • MULTIPLE DRILLING ATTACHMENTS AND MACHINES • TAPPING MACHINES • END FACING AND CENTERING MACHINES SPECIAL MACHINE TOOLS FOR HIGH PRODUCTION.

OF EXTERNAL AND INTERNAL GEARS, BEVELS, CLUTCHES AND SPLINES. MADE IN TWO SIZES FOR WORK UP TO 10" AND 20" DIAMETER

See the name MERCER

REGISTERED TRADE MARK



First

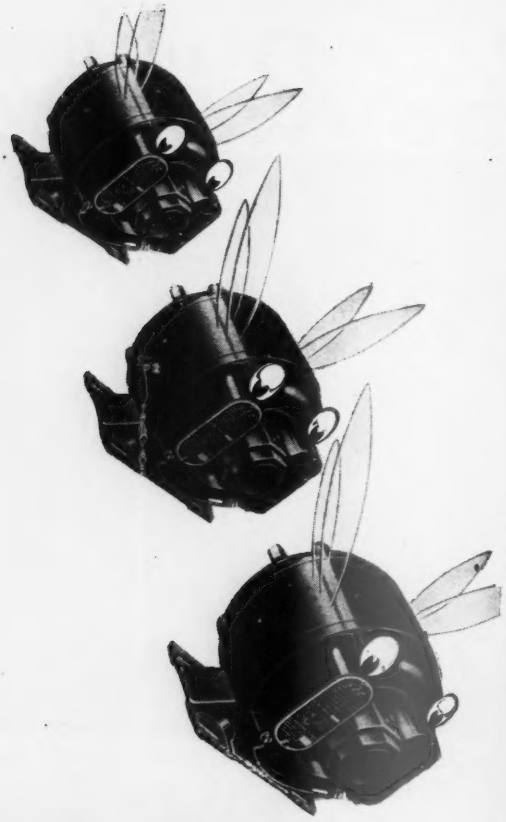
AND STILL LEADING IN DIAL GAUGE MANUFACTURE

THOMAS MERCER LTD

Est. 1858

Makers of the famous MERCER gauges

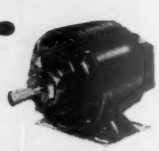
SALES and SERVICE EYWOOD ROAD • ST. ALBANS • ENGLAND TELEPHONE ST. ALBANS 5313/5



..a Bee line to greater production..

. . . where industry is at high pressure, there go the G.E.C. "Fractionals". The rotors of G.E.C. "Fractionals" are spinning in almost every field of Engineering where reliability and service are MUSTS. There is a G.E.C. "Fractional" for every purpose ready for IMMEDIATE DELIVERY. Straight from the G.E.C. production line —ready to make a BEE LINE to YOU.

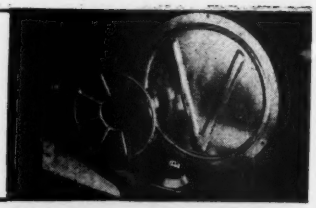
G.E.C.



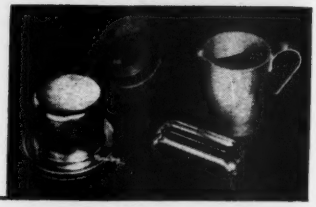
"Fractionals"

THE GENERAL ELECTRIC CO. LTD.

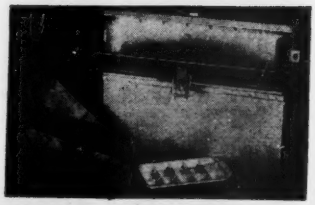
METAL PRESSINGS



DEEP DRAWINGS



ASSEMBLY WORK



all done by . . .

SAMUEL GROVES & CO. LTD.

MUSGRAVE ROAD,
BIRMINGHAM, 18.

GP2a

Our specialised knowledge is offered to you in the supply of Castings from a few ounces up to 5 tons—in
PHOSPHOR BRONZE, GUNMETAL,
MANGANESE BRONZE, ALUMINIUM BRONZE
(Tensile Strength 45 tons per sq. in.)
ALSO
Light Alloy Castings. 'BIRSO' Chill-Cast Rods and Tubes
Centrifugally-Cast Worm-wheel Blanks. Ingot Metals
Phosphor Copper. Phosphor Tin. Precision Machined Parts
Finished Propellers, etc.

Fully approved by Admiralty and A.I.D.

T. M. BIRKETT & SONS LTD.
HANLEY · STAFFS
Grams : Birkett, Hanley 'Phone : Stoke-on-Trent 2184-5-6

in association with

BILLINGTON & NEWTON LTD.
LONGPORT, STOKE-ON-TRENT
'Grams : Bronze, Phone, Longport 'Phone : Stoke-on-Trent 87303-4 & 88147
B118

High Performance

.....needs perfect balance. Laystalls who have made Racing Crankshafts for nearly forty years, specialise in those jobs that need to be rather better than standard.

LAYSTALL CRANKSHAFTS are made in all types from Refrigerator to Marine Diesel.

Specialised Repairs for the Trade and Private Motorist.

Crankshaft Grinding. Complete Engine Overhauls.
Crankshaft Balancing. Oxy-Acetylene & Arc Welding.
"CROMARD" Cylinder Liners. Nitralloy Brake Drum Liners.
General Machining, etc.

MAKERS OF THE FAMOUS LAYSTALL "CROMARD" LINERS

LAYSTALL ENGINEERING COMPANY LTD.

Head Office: 53 GREAT SUFFOLK STREET, LONDON, S.E.1.
Tel. WATERLOO 6141
Northern Branch: 63 St. ANNE STREET, LIVERPOOL.
Tel. LIVERPOOL NORTH 0178
Works: LONDON, LIVERPOOL and WEDNESFIELD.

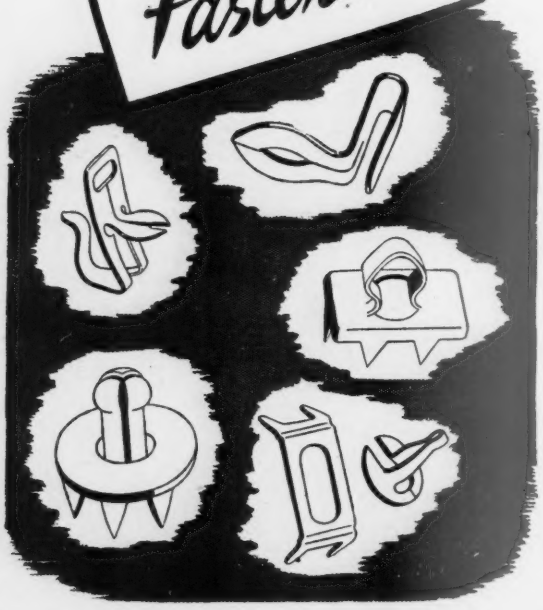
ystall Laystall Laystall Laystall Laystal

FOR
Diecastings as strong as steel
ALUMINIUM BRONZE CO., LTD.
Wallows Lane · Walsall · Staffs.
Telephone WALSALL 2108 (3 lines)
Telegrams "ABCO WALSALL"

CUT £ABOUR COT

with

Carr Fasteners



Drawn from a great stock of proven designs, or made especially for you. Carr Fasteners can save you time, improve your product. If you have anything you want to fasten to anything else first consult Carrs and learn the short-cuts.

CARR FASTENER CO., LTD.

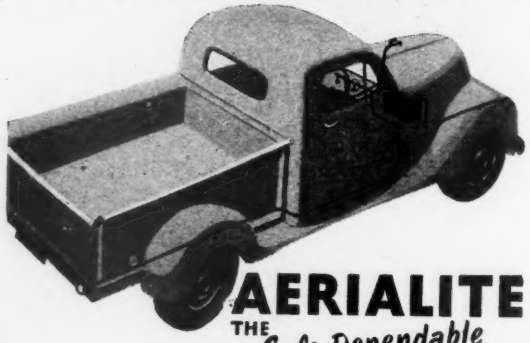
STAPLEFORD, NOTTINGHAM TEL: SANDIACRE 2234

DOT

Ignore this, and it may cost you money!

Faulty ignition, indifferent lighting, inefficient charging, all cause delay and consequent loss of money. At the first sign of any of these danger signals, do the wise thing, have your truck re-wired with AERIALITE, the Safe, dependable Auto Cable.

AERIALITE LTD., STALYBRIDGE, Cheshire



AERIALITE

THE *Safe, Dependable* AUTO CABLE

The **NEWTON** *Profile Projector*

Two Sizes x 10 and x 25.

Sturdy construction, simplicity of operation and laboratory accuracy combine to make this projector ideal for use on the production line.

Daylight Operation.

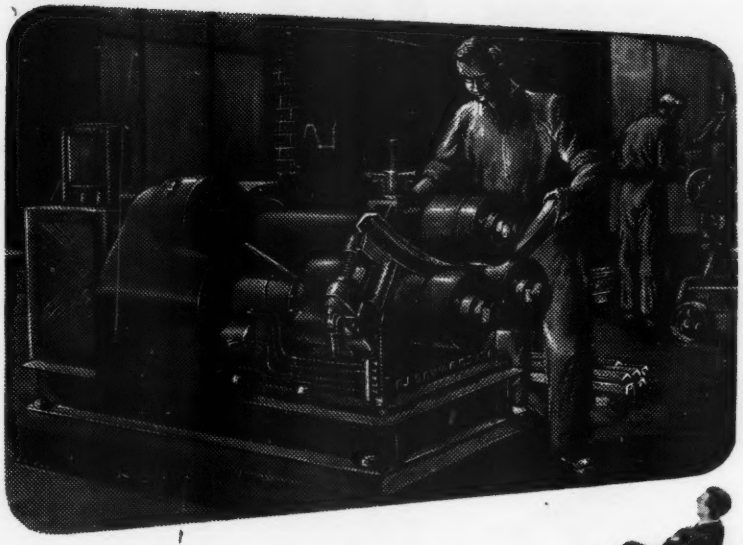
Full details from . . .

NEWTON & Co. Ltd.

(Associated with Metropolitan-Vickers Electrical Co., Ltd.)

72 WIGMORE ST., LONDON, W.1.

Tel Welbeck 7977



talking of machinery... think of Edwards'!

for the latest developments in sheet metal machinery, emphasised by this illustration of the new Besco Open End Vertical Section Bending Machine and for new and used metal and woodworking plant and machine tools.

F. J. EDWARDS LTD., 359–361 EUSTON RD., LONDON, N.W.1

JAGUAR CARS

are fitted with

MARSTON RADIATORS

Mr. Leslie Johnson, driving a Jaguar XK120 Sports, won the Production Car race at Silverstone last August, and at Palm Beach, Florida, in January of this year, he won a similar event, also receiving a special prize for the best performance by a British car.

With a Marston Mark VII film block, the Jaguar has the highest radiator efficiency obtainable today.

MARSTON EXCELSIOR LIMITED,

(A subsidiary company of Imperial Chemical Industries Ltd.)

WOLVERHAMPTON or LEEDS

Tel: Fordhouses 2181

MAR 83

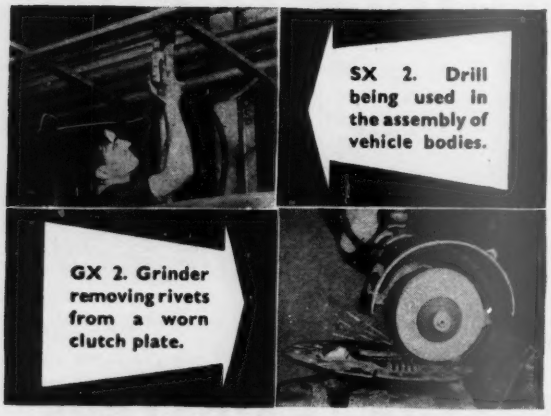
7 aids to greater production

Public Authorities and progressive Engineering Companies acknowledge the efficiency and reliability of "Broomwade" tools.

By standardising on "Broomwade" equipment, jobs are kept moving ahead of schedule, production maintained at high level and working costs kept low.

Illustrated above is a selection of tools from the "Broomwade" range :—

1. SX 2 Drill.
2. Type No. 6A Wire Brush.
3. MC.2. Screw Driver.
4. GR.2. Grinder.
5. Type No. 6A Drill.
6. D.R.2. Riveter.
7. D.3. Medium Duty Chipping Hammer.



"BROOMWADE"

Air Compressors & Pneumatic Tools

BROOM & WADE LTD · HIGH WYCOMBE · BUCKS

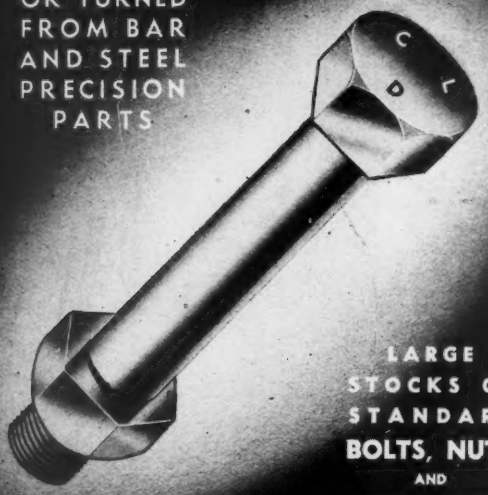
'Phone: High Wycomb: 1630 (8 lines) Grams: Broom, High Wycombe.

BR 105 dm

LINDLEY

for **HIGH GRADE BOLTS**

COLD HEADED OR TURNED FROM BAR AND STEEL PRECISION PARTS



LARGE STOCKS OF STANDARD **BOLTS, NUTS** AND **SET SCREWS**

C. LINDLEY & CO. LTD.

ENGLEFIELD ROAD, LONDON, N.1.

Phone CLISSOLD 0643 (4 lines) Grams: BEAUVOIR, NORDO, LONDON

AH— TISHOO!

Coughs and colds spread like wildfire and are a serious cause of ABSENTEEISM.

We can help you combat and confine infection with our preparations, some of which are listed below.

Send for particulars and prices :—

★ **SYRUP PINI. CO. CUM KREOSOTE.** This is very palatable, has a powerful antiseptic effect against the persistent cough, and diminishes the risk of infection spreading.

★ **"QUINCABEL" FOR COLDS.** Assists in arresting the development of a cold or in its dispersement.

★ **"G.P." GERMICIDE & ANTISEPTIC.** An essential as a general infection combatant.

★ **"AMARATONE" TONIC.** A first class tonic when vitality is low, for building up resistance to infection.

★ **A.P.C. TABLETS:**—(Aspirin, Phenacetin, Caffein). A splendid prophylactic in cases of pains and colds.

★ **"SANOID" ANTISEPTIC SPRAYING SOLUTION.** A pleasant and effective anti-infection spraying solution.

★ **IODISED THROAT TABLETS.** An effective means of disinfecting the mouth and throat and reducing infection spreading.

CUXSON, GERRARD & CO. LTD.

SPECIALISTS IN FIRST AID

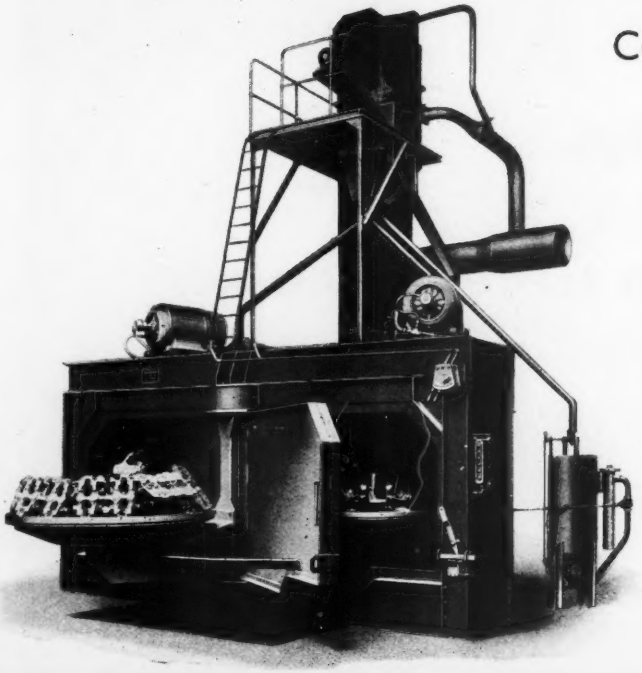
OLDBURY, BIRMINGHAM Phone Broadwell 1355

TILGHMAN'S

WHEELABRATORS

FOR

CONTINUOUS ABRASIVE CLEANING



The Machine illustrated, Symbol W.S.T.6.D, with two 6ft. diameter tables, is capable of cleaning up to 5 tons of castings, forgings etc. per hour.

Four other sizes available Send for details.

TILGHMAN'S PATENT SAND BLAST Co. Ltd

BROADHEATH, NR. MANCHESTER

Phone: ALTRINCHAM 4242

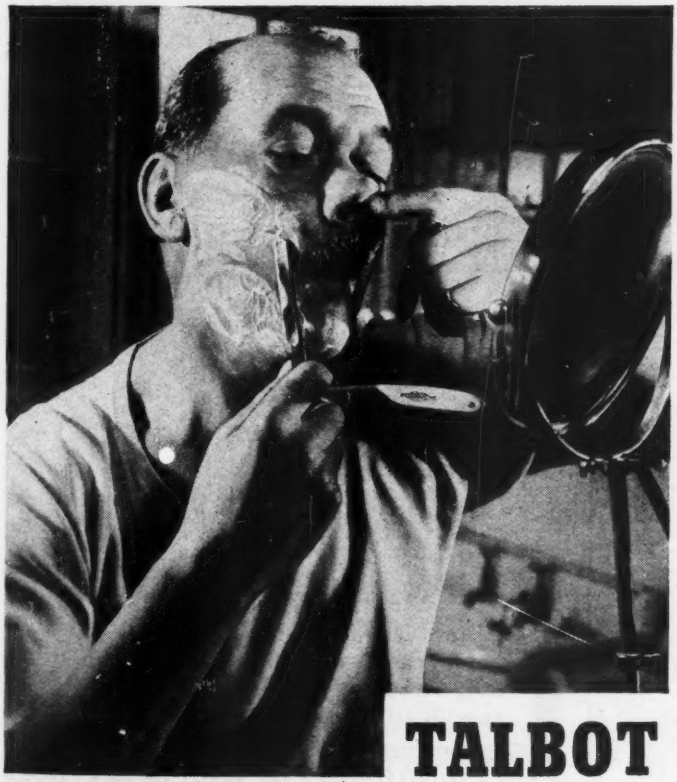
London Office: 17 GROSVENOR GARDENS, S.W.1

Phone: Vic. 2586

HOME AGENTS

Midlands: R. J. Richardson & Sons Ltd., Commercial Street, Birmingham.

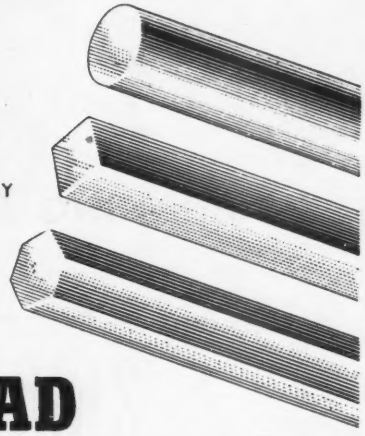
Scotland: Mitchell Graham & Son Ltd., 56 Buccleugh St., Edinburgh. J.11



TO CLOSE LIMITS

Talbot Stead can supply bright drawn and turned steel bars in round, square or hexagon and to close limits

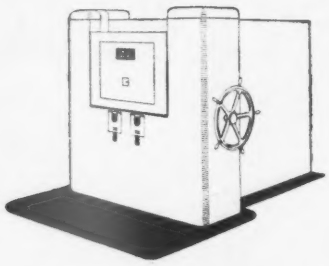
A COMPANY



TALBOT STEAD

TALBOT STEAD TUBE CO LTD · GREEN LANE · WALSALL

TBWS



There are

WILD-BARFIELD ELECTRIC FURNACES

for all heat-treatment purposes

ELECTRIC WILD BARFIELD FURNACES

*The illustration shows a typical "Heavy-Hairpin" furnace for carburizing, reheating and hardening

WILD-BARFIELD ELECTRIC FURNACES LTD., ELECFURN WORKS, WATFORD BY-PASS WATFORD, HERTS
TELEPHONE: WATFORD 6094 (4 LINES) TELEGRAMS & CABLES: ELECFURN, WATFORD

gM-W307

Equip with KING DICK

Send for our comprehensive catalogue which contains details of our range of Socket Sets and numerous other Hand Tools.

Abingdon KING DICK LTD
ABINGDON WORKS · KINGS ROAD · TYSELEY · BIRMINGHAM 11

CARBON & ALLOY
in all standard sections. Also supplied fully heat treated, to engineering specifications.

KIRKSTALL FORGE ENGINEERING LTD LEEDS 5
TEL: HORSFORTH 2821

Quality Products by

WELLWORTHY

For the motor manufacturer only the best is good enough. That is why most of the leading designers specify WELLWORTHY Pistons, Rings, Liners, Valve Seats etc. and why YOU should make a point of refitting with WELLWORTHY. You will thus ensure performance equal to new, and obtain complete satisfaction.

The Choice of the Expert

25 Service Branches throughout the United Kingdom.

WELLWORTHY PISTON RINGS LTD · LYMINGTON · HANTS

Tested and recommended by the Ministry of Supply (MTV Branch) Ref. No. VG. 6/300/FIR for export to tropical countries.

Here is the perfect jointing for high pressure smooth surface or screw unions!

OSOTITE

A SLICK- PRODUCT

OSOTITE — the modern, scientific sealing which has been proved by rigorous tests to be the perfect jointing for smooth surface and screw unions. OSOTITE is a simply applied, liquid compound, impervious to heat, petrol, oil, grease, water and steam which ensures in a few minutes a HIGH PRESSURE GAS, AIR or WATER-TIGHT JOINT.

Write for full details and prices to:—

SLICK BRANDS LIMITED

STAFFORD ROAD, WADDON, CROYDON, ENGLAND

Tel: CROYDON [illegible] Cables: SLICKBRA, SOUPHONE, LONDON

ACCLES & POLLOCK

DAPTA
TRADE MARK

SEAT FRAMES never let you down

Dapta Seats will save pounds because they last as long as the 'bus. They are produced to exacting standards of design, materials and workmanship; and are the result of years of study of comfort, efficiency, easy installation and low maintenance costs.

ACCLES & POLLOCK LTD · OLDBURY · BIRMINGHAM A COMPANY

TBW/N

Controls to stay

. . . and Bowden controls, which have already been in use for 53 years, are likely to stay longer than any. But if all controls were appreciated by industry as are Bowden mechanisms, everyone would be happy.

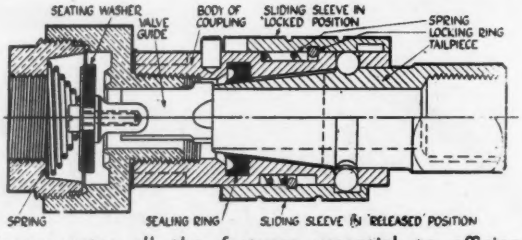
Bowden

CONTROL MECHANISMS

BOWDEN (Engineers) LIMITED, LONDON, N.W.10

AS-118

The new F & J BRAKE COUPLING



"Incorporates all the features essential to efficiency for both air–pressure and vacuum braking systems". (Commercial Motor, May 12, 1950.)

Full details gladly sent on request.

FEENEY & JOHNSON LTD.

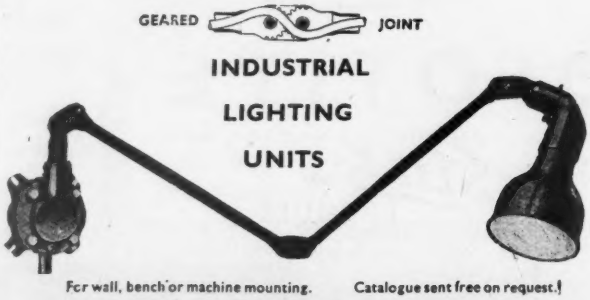
134-136 Ealing Road, Wembley, Middx. Tel : Wembley 4801/2

DHB

MEKELITE

GEARED JOINT

INDUSTRIAL LIGHTING UNITS



For wall, bench or machine mounting. Catalogue sent free on request.

MEK-ELEK Engineering Ltd, MITcham 3072

17, Western Road, Mitcham, Surrey.

DELCO IGNITION

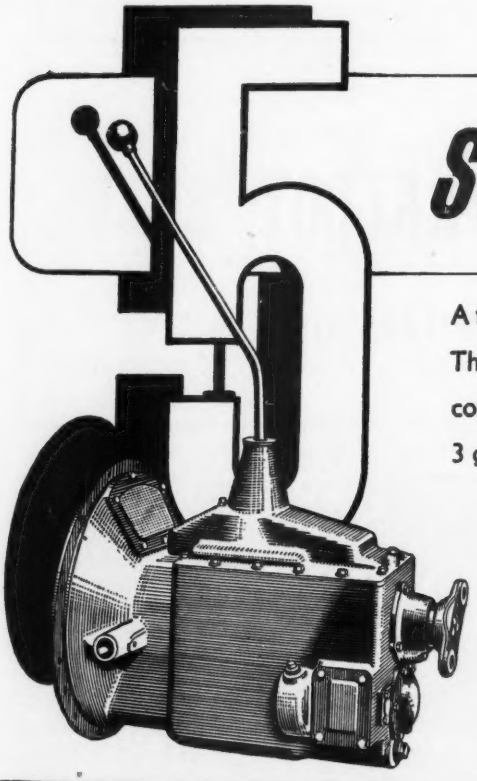
BRITISH MADE

Automobile Engineers who demand unfailing reliability consult Delco technicians on all aspects of Ignition Equipment

DRH DELCO-REMY-HYATT

DIVISION OF GENERAL MOTORS LTD

111 GROSVENOR ROAD · LONDON · S.W.1



5 SPEED GEAR BOX

A five-speed gearbox suitable for 230 lb. feet engine torque. There are four speeds, plus an overdrive and reverse, and complete weight of the box with bell housing is 1 cwt. 3 qrs. 18 lb.

SEND YOUR ENQUIRIES

THE MOSS GEAR CO LTD

CROWN WORKS · TYBURN · BIRMINGHAM · 24

Indian Rope trick

Not at all-just an

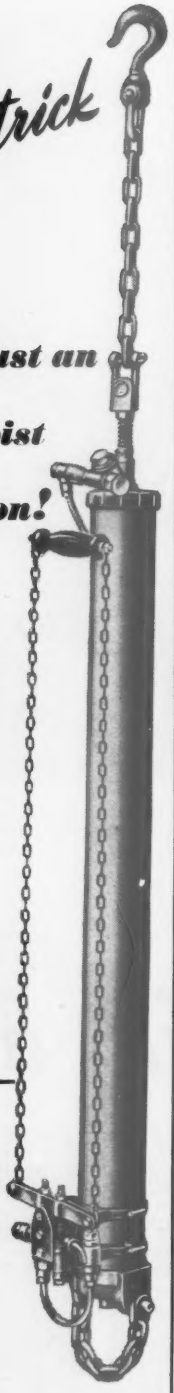
Enots Pneumatic Hoist

in an impossible position!

Perhaps it is our love of the seemingly impossible problems we receive from time to time that has earned for us an "Indian Rope Trick" reputation with our many customers all over the world.

There is nothing mysterious about the performance of the Enots Pneumatic Hoist however, although the ease with which it will lift a 250 or 500 lbs.* weight has often been a source of wonder to those who see it in action for the first time.

This is only one of many mechanical handling problems that Enots Pneumatic Equipment can solve — send your enquiry NOW to the "Indian Rope Trick" specialists.



★ ***STOCK SIZES***

A.C. 416		***A.C. 417***	
Bore: 2½" Lift: 250 lbs. approx. at 80 lbs. per sq. inch line pressure.		Bore: 3" Lift: 500 lbs. approx. at 80 lbs. per sq. inch line pressure.	
Prices		Prices	
3 ft. Hoist	£11 10 0	3 ft. Hoist	£16 0 0
4 ft. Hoist	£12 15 0	4 ft. Hoist	£18 0 0
5 ft. Hoist	£14 0 0	5 ft. Hoist	£20 0 0

ALL PRICES PLUS 10%

Enots

pneumatic HOISTS

BENTON & STONE LTD · BIRMINGHAM · 6

established 1814

automatic heat from ...

FEATURES

1. Consistent and controllable heat.
2. Incorporates an entirely new feature of fuel feed, eliminating the troublesome screw feed.
3. Fuel economy.
4. Silent in operation.
5. Simple and of a robust construction.
6. Infinite control over fuel and air supply.
7. Accessibility.
8. Fully automatic.
9. Lower power consumption.

As a result of their 70 years' experience in mechanical stoker manufacturing and combustion engineering B.C.L. are now able to present to Heating and Ventilating Engineers and Industry in general their latest development—the ZENITH STOKER—a worthy addition to the well known Bennis range.

... BENNIS

Zenith

STOKERS

the stoker with a difference

BENNIS COMBUSTION LTD. LITTLE HULTON BOLTON
LONDON OFFICE 28 VICTORIA STREET S.W.1

BI1/56

For Optimum Hardness and Strength

NITRIDED

NITRALLOY STEEL

Particulars from

NITRALLOY LIMITED

25 TAPTONVILLE ROAD, SHEFFIELD, 10

Telephone : 60689 SHEFFIELD *Telegrams : NITRALLOY SHEFFIELD*

PITMAN'S

Automobile Maintenance Series

AUTOMOBILE WORKSHOP PRACTICE

By Staton Abbey. This new addition to the series links theory with practice, with particular emphasis on the various aspects of repair and maintenance work which are not necessarily covered by workshop experience alone. It meets the requirements of the training syllabus recommended by the National Joint Industrial Council, and of the City and Guilds of London Institute examinations. With 76 illustrations. 10/6 net.

PITMAN, Parker Street, Kingsway, London, W.C.2

Clyde Alloy Steels

IN THE AUTOMOBILE INDUSTRY

Heavy Duty
Gear Steels

●

Carburising Steels
For Every Purpose

●

Stainless Steels
Of All Types

●

Valve Steels
For All Engines

●

Ball And Roller
Bearing Steels

●

Torsion Bar Steel

Alloy steels are produced in bar or billet form for drop stamping, and as black or bright bar in the rolled, softened, or heat treated condition for machining. The qualities manufactured cover the entire range of British and American automobile practice, and can be supplied in either Open Hearth or Electrically Melted Grades.

Every alloy steel requirement for engine, transmission, or chassis components can be met by our products which have been in widespread use in the motor-car industry for many years.

THE Clyde Alloy STEEL CO LTD · MOTHERWELL

Telephone : MOTHERWELL 1051 (6 lines) *Telegrams :* "CLYDALL, MOTHERWELL"

Rathbone

CLASSIFIED ADVERTISEMENTS

RATE 4d. per word, minimum 4/-. Each paragraph charged separately. Box numbers —5 words plus 1/-. No responsibility accepted for errors.

PATENTS

THE proprietor of British Patent No. 561014, entitled "Two-Way Clutch," offers same for license or otherwise to ensure practical working in Great Britain.—Enquiries to Singer, Stern & Carlberg, 14, East Jackson Blvd., Chicago 4, Illinois, U.S.A. [4286

THE proprietor of British Patent No. 578633, entitled "Improvements in Articulated Road Vehicles" offers same for license or otherwise to ensure practical working in Great Britain.—Enquiries to Singer, Stern & Carlberg, 14E., Jackson Boulevard, Chicago 4, Illinois, U.S.A. [4314

THE proprietor of British Patent No. 525890, entitled "Method of operating an internal combustion engine" offers same for license or otherwise to ensure practical working in Great Britian. Enquiries to Singer, Stern & Carlberg, 14.E., Jackson Boulevard, Chicago 4, Illinois, U.S.A. [4313

THE proprietor of British Patent No. 541016, entitled "Valve Construction" offers same for license or otherwise to ensure practical working in Great Britain. Enquiries to Singer, Stern & Carlberg, 14, East Jackson Boulevard, Chicago 4, Illinois, U.S.A. [4337

THE proprietor of British Patent No. 556818, entitled "Brake Control Mechanism" offers same for license or otherwise to ensure practical working in Great Britain.—Enquiries to Singer, Stern & Carlberg, 14, East Jackson Boulevard, Chicago 4, Illinois, U.S.A. [4338

MATERIALS

STAINLESS steel, sheet, bar, tube, large stocks held to most specs., A.I.D. approved stockholders; monthly stock list gladly sent on request.—Taylor Stainless Metals, Ltd., Slough, Bucks. Tel. Slough 21381. [4176

TUITION

A.M.I.M.I., City and Guilds, A.M.I.Mech.E., etc., on "no pass no fee" terms, over 95% successes, for details of exams. and courses in all branches of Auto., Aero., Mechanical Eng., etc., write for 176-page handbook—free.—B.I.E.T. (Dept. 724), 17, Stratford Place, London, W.1. [4294

MACHINERY WANTED

WANTED, all classes of machine tools, also presses and sheet metal working machinery of every description; best prices paid.

F. J. EDWARDS, Ltd., 359-361, Euston Rd., London, N.W.1. Tel. Euston 4681 and 3771. Telegrams: Bescotools, Norwest, London. [3407

BUSINESS PROPERTY

EDINBURGH (near). Garage Business for sale; old established; excellent property; three cars; good reasons for sale; early entry.—Apply Box 2035, Robertson & Scott, Edinburgh, 2. [4330

SITUATIONS WANTED

SPORTSMAN-driver, 20 years experience, with engineering background, seeks employment.—Box 7295, c/o Automobile Engineer. [4328

SITUATIONS VACANT

MAJOR Oil Company require an Automobile Engineer/Buyer of good personality for duty in London to handle the purchase of cars, spares and accessories. Age 25-30; qualifications—Secondary Education—graduateship or studentship in I.Mech.E. (Automobile Section) or Higher National Certificate in Engineering, with apprenticeship with one of the large automobile manufacturers and subsequent administrative service within the Industry—knowledge of Stores procedure would be of advantage.—Write, giving full details of qualifications and experience quoting Department M.1440 to Box 6000 at 191, Gresham House, E.C.2. [4329

BRITISH Racing Motors Limited, Bourne, Lincs., require Senior and Improver Draughtsmen, possessing Ordinary or Higher National Certificates, and having had Works apprenticeship with firms in the Automobile Industry.—Apply, stating experience, etc., to the Secretary. [4331

DESIGNER with experience of both passenger and commercial vehicles urgently required by a Midland Commercial Vehicle Manufacturer. Apply, giving details of training, both practical and technical, and experience to Box 6688, c/o Automobile Engineer. [4317

RESTRICTORS

to the specific requirements of our customers

· Makers of all types of repetition products from the bar in all metals

M·C·L AND REPETITION LTD
POOL LANE
LANGLEY, BIRMINGHAM
Phone:
BROadwell 1115 (4 lines)
and BROadwell 1757

FORTIS TOOLS LTD 91 STATION ST., BIRMINGHAM 5
or your local dealer

COTTON BAGS
FOR SPARE PARTS, Etc.
Walter H. Feltham & Son Ltd
Imperial Works, Tower Bridge Road,
Telephone: HOP 1784. LONDON, S.E.1

SITUATIONS VACANT

A MAJOR British Oil Company has following vacancies for Senior Staff in its new Workshops in the Middle East engaged on major overhaul. (1) Superintendent, Construction Plant Maintenance Department (Earthmoving Equipment, Cranes, Welding and Lighting Sets, Concrete Mixers, Pumps, etc.); (2) Inspector, Construction Plant Maintenance; (3) Engineer i/c Engine Shop (wide range of C.I. and I.C. engines up to 400 H.P. and 125 H.P. respectively); (4) Inspector, Engine Shop; (5) Superintendent, Motor Transport Maintenance Department (range, light cars to heavy diesel vehicles); (6) Inspector, Motor Transport Maintenance. Applicants must have sound technical background and proved practical experience in their particular field, be good organisers with initiative and drive, and capable of handling skilled and unskilled labour. Corporate Membership of Institute of Mechanical Engineers desirable. Maximum age limit 45 years. Attractive salary with generous allowance in local currency, free passages, kit allowance, free medical attention, good leave arrangements and Pension Scheme.—Write fully, giving personal particulars and details of qualifications and experience, stating post for which application is made, and quoting Department F.217, to Box 3090 at 191, Gresham House, E.C.2. [4332

SENIOR Automobile Engine Designer required by well-established manufacturing Company, London district. Excellent prospects for suitable applicant.—Write, stating age, experience and salary required to Box 7296, c/o Automobile Engineer. [4333

VERY Senior Automobile Engineers required, having wide experience and responsibility, for car chassis, truck chassis and engine (petrol, P.V.O. and diesel) design. Applicants must have proved ability to control and direct labour. Will be required to carry through complete projects. Permanent and progressive posts. Pension Scheme. Appointments to commence approximately March 1st, 1951. Second interviews for short-listed candidates. Four-figure salaries paid to those successful. London area.—Write, stating education, experience and fullest information to Box 7373, c/o Automobile Engineer. [4336

MECHANICAL Engineer, age 23-30, having B.Sc. or H.N.C., required for research and development work in association with internal combustion engines and accessory equipment. Some practical experience, including engine testing would be an advantage. The position is permanent and offers good prospects for advancement.—Write, stating age, qualifications and experience to Personnel Manager, Joseph Lucas Limited, Great King Street, Birmingham. [4334

CONTRACTS manager for estimating, tender and order department required by large manufacturers of high-speed diesel engines in the Midlands.—State age, experience and salary required. Box 7372, c/o Automobile Engineer. [4335

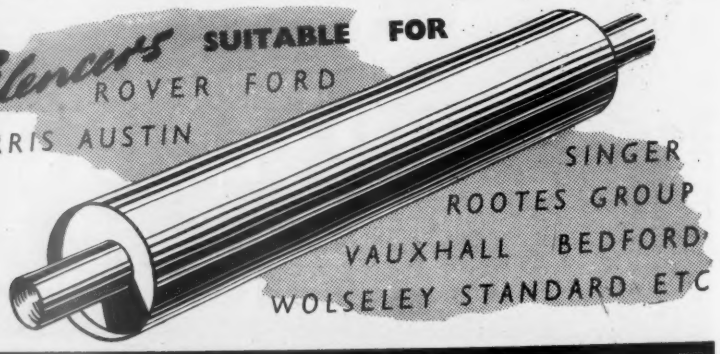
GUY MOTORS LTD., Wolverhampton, have vacancies for first class chassis designers and draughtsmen. Automobile experience and High National Certificate desirable. [4322

COMMERCIAL vehicle designer, preferably with Higher National Certificate in Mechanical Engineering and fully experienced in automobile design, required by Guy Motors, Ltd., Wolverhampton.—Apply, giving full details of experience. [4251

EXPERIENCED Draughtsmen required for commercial vehicle chassis design, North Western District. First-class men only need apply. Give full particulars of experience and salary required to Box 6686, c/o Automobile Engineer. [4316

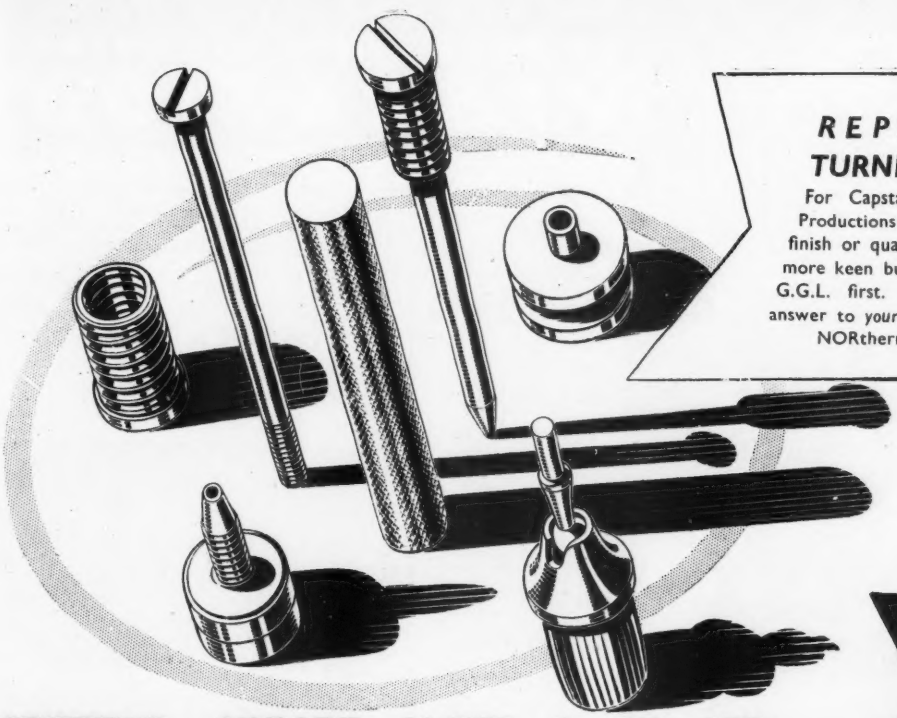
W. G. Walker & Co. (Engineers) Ltd.
FOR
DYNAMOMETERS
Frac: to 600 B.H.P. 0 to 9,000 R.P.M.
Emery Hill St., Westminster, S.W.1.
Tel. VICtoria 1622

CE-LAST
Replacement Silencers SUITABLE FOR
ROVER FORD
MORRIS AUSTIN
SINGER
ROOTES GROUP
VAUXHALL BEDFORD
WOLSELEY STANDARD ETC



CE-LAST Replacement Silencers are suitable for all these makes—and many more. Your customers will ask for CE-LAST—send now for our comprehensive price list.

SILENCERS (BOLTON) LTD · WATERLOO ST · BOLTON LANCS · Tel Bolton 4240 (2 lines) Grams: "Gates" Bolton
dm SR.3



REPETITION TURNED PARTS

For Capstan and Automatic Productions in any metal or finish or quantity. More and more keen buyers are asking G.G.L. first. For a quick answer to *your* problem ring NORthern 2132

G·G·L

GRIFFITHS, GILBART, LLOYD & CO. LTD.
EMPIRE WORKS · PARK ROAD · BIRMINGHAM 18

Overhead travelling cranes, electric hoist blocks, conveyors, elevators, telphers, runways, foundry mechanisation.

Conveyor scheme by Paterson Hughes carries the Hillman Minx through all its assembly stages.

PATERSON HUGHES
ENGINEERING COMPANY LIMITED

Bedford House,
Bedford Street,
Strand, LONDON, W.C.2.
Telephone : Temple Bar 7274/6.

30, Horse Fair, BIRMINGHAM 1.

Wyndford Works,
Lochburn Road
Maryhill, GLASGOW, N.W.
Telephone : Maryhill 2172/4

Telephone : Midland 3435

I've just realised FELT provides the answer

You would be surprised how many times felt *does* provide the answer. Seldom in the limelight, this amazingly versatile material serves industry in a thousand ways. If it is not already serving you, it will be worth your while to consult Coopers who will be pleased to discuss your problem.

COOPERS
INDUSTRIAL **FELT** PRODUCTS

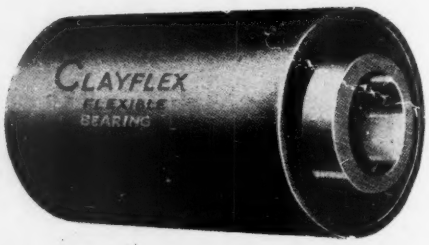
Telephone : NORthern 2194-5 *Telegrams* : Felting, Birmingham
Cooper & Co. (B'ham) Ltd., Little King St., Birmingham 19

SO LITTLE WHICH MEANS SO MUCH WHEN STUDYING VIBRATION

"CLAYFLEX FLEXIBLE BEARINGS" are engineered to give predictable performance. Deflection is controlled by size and design of metal sleeves and elongation of rubber. Rubber stays "ALIVE" and cannot rupture. They are being applied to innumerable applications, four of which are illustrated. Any size to support ounces or tons.

"CLAYFLEX (Patented) FLEXIBLE BEARINGS" are, in effect, articulated JOINT BEARINGS, the elastic elements of which have as their chief objectives :—

(a) flexibility of movement.
(b) absorption of vibration and shock.
(c) elimination of noise.
(d) provision of electrical insulation.
(e) elimination of lubrication or attention.



CLAYFLEX
FLEXIBLE BEARINGS

We shall be pleased to forward Technical Brochures. Our staff of specialised Technicians are entirely at your service to advise on efficient applications.

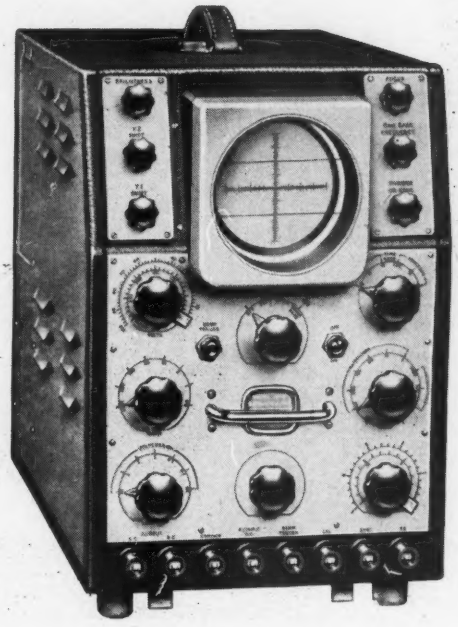
HOWARD CLAYTON-WRIGHT LTD.
WELLESBOURNE · WARWICKSHIRE.
PHONE:- WELLESBOURNE 3167-8.
GRAMS:- 'CLATONRITE WELLESBOURNE'

INDEX TO MANUFACTURERS' ANNOUNCEMENTS

	PAGE
Abingdon King Dick, Ltd.	116
AC Sphinx Spark Plug Co.	27
Accles & Pollock, Ltd.	118
Acheson Colloids, Ltd.	63
Adamant Engineering Co., Ltd.	61
Aerialite, Ltd.	112
Allied Paints and Chemicals	98
Aluminium Bronze Co., Ltd.	111
Amal, Ltd.	96
Andrews, Harold, Grinding Co., Ltd.	41
Angus, George, & Co., Ltd.	99
Applied High Frequency	72
Archdale, James, & Co., Ltd.	76
Automotive Engineering Co., Ltd.	69
Automotive Products Co., Ltd.	9, 10, 11, 12
Bennis Combustion, Ltd.	120
Benton & Stone, Ltd.	120
Berger, Lewis, & Sons, Ltd.	8
Berry, Richard, & Son	65
Birkett, T. M., & Sons, Ltd.	110
Birmingham Aluminium Casting (1903) Co., Ltd.	Cover iv
Black & Decker, Ltd.	26
Booth, James, & Co., Ltd.	75
Bound Brook Bearings (G.B.), Ltd.	53
Bowden (Engineers), Ltd.	118
British Belting & Asbestos, Ltd.	7
British Driver-Harris Co., Ltd.	105
British Electrical Developments Association	55
British Oxygen Co., Ltd., The	88
British Timken, Ltd.	Cover i
Broom & Wade, Ltd.	114
Brown, David, & Sons (Huddersfield), Ltd.	34
Bryce Fuel Injection, Ltd.	58
Burton, Griffiths & Co., Ltd.	23
Cape Asbestos Co., Ltd., The	22
Carr Fastener Co., Ltd.	112
Cashmore, John, Ltd.	104
C.A.V., Ltd.	38
Clancey, G., Ltd.	86
Clayton Dewandre Co., Ltd.	70
Clayton-Wright, Howard, Ltd.	124
Cleveland Petroleum Co., Ltd.	66
Clifford, Charles, & Son, Ltd.	105
Climax Molybdenum Co. of Europe, Ltd.	3
Clyde Alloy Steel Co., Ltd.	112
Cocker Bros., Ltd.	80
Cole, E. K., Ltd.	102
Collier & Collier, Ltd.	108
Cooper & Co.(Birmingham),Ltd.	123
Cork Manufacturing Co., Ltd.	54
Corrugated Packing & Sheet Metal Co., Ltd.	94
Cossor, A. C., Ltd.	Cover iii
Coventry Motor Fittings Co., Ltd.	37
Cuxson, Gerrard & Co., Ltd.	114
Dale, John, Ltd.	107
Delco-Remy & Hyatt, Ltd.	119
Dobbie, McInnes, Ltd.	100
Dunford & Elliott (Sheffield), Ltd.	98
Dunlop Rubber Co., Ltd.	36
Eaton Axles, Ltd.	79
Edwards, F. J., Ltd.	113
English Electric Co., Ltd.	90
English Steel Corporation Ltd.	Cover ii
Feeny & Johnson, Ltd.	118
Feltham, Walter H., & Son, Ltd.	122
Fenner, J. H., & Co., Ltd.	108
Ferodo, Ltd.	16
Firth, Thomas, & John Brown, Ltd.	47
Fischer Bearings Co., Ltd.	40
Fisher & Ludlow, Ltd.	6
Fletcher, Miller, Ltd.	108
Fortis Tools, Ltd.	122
Fuller, Horsey, Sons & Cassell	121
Gas Council, The	56
General Electric Co., Ltd.	46, 110
Girdex Engineering Co., Ltd.	102
Girling, Ltd.	19
Glacier Metal Co., Ltd., The	78
Great Eastern Oil Co., Ltd., The	106
Griffiths, Gilbart, Lloyd & Co., Ltd.	123
Groves, Samuel, & Co., Ltd.	110
Guest, Keen & Nettlefold (Midlands), Ltd.	106
Hadfields, Ltd.	42
Hardy, Spicer & Co., Ltd.	60
Harper, John & Co., Ltd.	13
Hassett & Harper, Ltd.	94
Helliwells (Treforest), Ltd.	30
Herbert, Alfred, Ltd.	43
Hey Engineering Co., Ltd.	109
Holroyd, John, & Co., Ltd.	71
Humphreys, J. H., & Sons	107
I.C.I. (Marston Excelsior), Ltd.	113
International Twist Drill Co., Ltd., The	103
Jackson, H., Ltd.	39
Jenks Bros., Ltd.	96
Jessop, William, & Sons, Ltd.	49
Kayser, Ellison & Co., Ltd.	83
Kendall & Gent, Ltd.	86
Kirkstall Forge, Ltd.	45, 116
Laystall Engineering Co.	111
Lewis Spring Co., Ltd.	100
Lindley, C., & Co., Ltd.	114
Lloyd's (Burton), Ltd.	97
Manganese Bronze & Brass Co., Ltd.	4
Marshall, C. & C., Ltd.	102
Marshall Organisation	90
McKecknie Bros., Ltd.	92
M.C.L. and Repetition, Ltd.	122
Mek-Elek Engineering, Ltd.	118
Mercer, Thomas, Ltd.	109
Metalastik, Ltd.	51
Metropolitan-Vickers Electrical Co., Ltd.	98
Midland Motor Cylinder Co., Ltd., The	82
Mills, William, Ltd.	101
Mond Nickel Co., Ltd., The	18
Monks & Crane, Ltd.	32
Monochrome, Ltd.	92
Morgan Crucible Co., Ltd., The	24
Morris, B. O., Ltd.	31
Moss Gear Co., Ltd.	119
National Savings Committee	100
Neill, James & Co. (Sheffield), Ltd.	88
Newall, A. P. & Co., Ltd.	48
Newton & Co.	112
Nitralloy, Ltd.	120
Paterson Hughes Engineering Co., Ltd.	123
Pitman, Sir Isaac, & Sons, Ltd.	120
Quasi-Arc Co., Ltd., The	103
Ransome & Marles Bearing Co., Ltd.	67
Regent Oil Co., Ltd.	87
Renfrew Foundries, Ltd.	52
Rockwell Machine Tool Co., Ltd.	85
Rozalex, Ltd.	94
Rubber Bonders, Ltd.	64
Rubery, Owen & Co., Ltd.	35
S. & D. Rivet Co.	106
Sheffield Twist Drill & Steel Co., Ltd., The	15
Shell-Mex & B.P., Ltd.	91
Silencers (Bolton), Ltd.	122
Silentbloc, Ltd.	2, 68
Simmonds Accessories Ltd.	50, 93
Simms Motor Units, Ltd.	44
Skefko Ball Bearing Co., Ltd., The	84
Slick Brands, Ltd.	117
Small & Parkes, Ltd.	81
Smethwick Drop-Forgings, Ltd.	5
Solex, Ltd.	62
Steel Company of Wales, Ltd., The	74
Sterling Metals, Ltd.	77
Talbot Stead Tool Co., Ltd.	115
Tecalemit, Ltd.	14
Terry, Herbert, & Sons, Ltd.	29
Thormann Engineering Co., Ltd.	104
T.I. Aluminium, Ltd.	28
Tilghman's Patent Sand Blasting Co., Ltd.	115
Toledo Woodhead Springs, Ltd.	25
Universal Dampers, Ltd.	20
Vandervell Products, Ltd.	95
Van Moppes & Sons (Diamond Tools), Ltd.	57
Walker, W. G., & Co. (Engineers), Ltd.	122
Ward, H. W., & Co.	96
Ward, Thomas W., Ltd.	101
Wellworthy Piston Rings, Ltd.	117
Westinghouse Brake & Signal Co., Ltd.	17
Weston, Charles, & Co., Ltd.	104
West Yorkshire Foundries, Ltd.	21
Wickman, A. C., Ltd.	1
Wiggin, Henry, & Co., Ltd.	73
Wild-Barfield Electric Furnaces, Ltd.	116
Wilmot-Breeden, Ltd.	33
Woodhead, Jonas, & Sons, Ltd.	59
Zinc Alloy Die Casters' Association	89

Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by James Cond Ltd., Charlotte Street, Birmingham 3. "The Automobile Engineer" can be obtained abroad from the following: AUSTRALIA & NEW ZEALAND: Gordon & Gotch Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service Ltd. Gordon & Gotch Ltd. SOUTH AFRICA: Central News Agency Ltd. Wm. Dawson & Sons (S.A.) Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office.

THE COSSOR DOUBLE BEAM OSCILLOGRAPHS



Can this Instrument solve a problem for you?

Here are some details of Model 1049 as illustrated:

The Double Beam Tube presents two simultaneous independent traces over the full diameter of a 90 mm. screen and provision is made for the measurement of both input voltage and time upon the calibrated dials of the instrument. The specification also includes facilities for Time Marking. The Oscillograph is particularly suited for the investigation of very low frequency phenomena and high-speed transients where writing speeds of 45 Km/sec. are attainable, using the Cossor Model 1428 Camera for which a Motor Drive Attachment Model 1429is available.

Widely different industries are daily finding new uses for the COSSOR Double Beam Oscillograph. Sometimes it provides the answer to an industrial problem of long standing. The tracing and measurement of noise, strain and vibration are typical everyday applications of this versatile instrument which is already helping engineers in industries as far apart as brewing and the manufacture of jet engines. Call on our technical advisory staff if you have a problem. They will quickly let you know whether the Oscillograph can help you.

COSSOR

Double Beam **OSCILLOGRAPHS**

Please address enquiries to :

A. C. COSSOR LTD., INSTRUMENT DIVISION, DEPT. N, HIGHBURY GROVE, LONDON, N.5

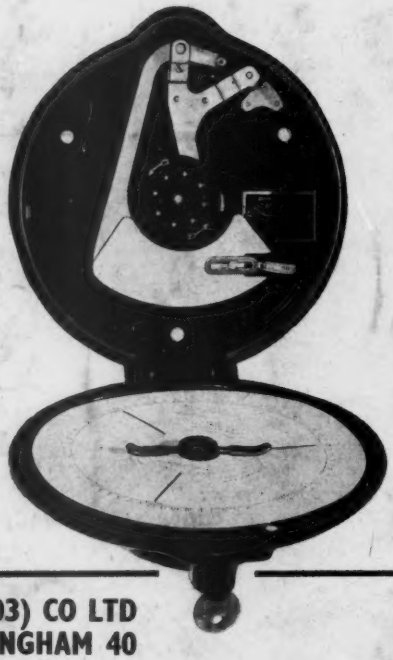
Telephone : CANonbury 1234 (30 *lines*)

CI.21

FOR REGULARITY OF FINISH

The illustration shows pressure die cast components for Servis Recorders. Our customer says, "We have been using your aluminium pressure castings for upwards of twenty years and we have found nothing to surpass them in regularity of finish. Our instruments are in use in all parts of the world and we have never yet had a single complaint regarding the parts you make for us. We have also come to appreciate and to rely on your Drawing Office and Design Staff, who have always been most helpful in the development of new types, and we look forward to continuing our co-operation with you for many years to come."

Extract from letter received from Servis Recorders., Gloucester,



BIRMINGHAM ALUMINIUM CASTING (1903) CO LTD
BIRMID WORKS · SMETHWICK · BIRMINGHAM 40